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THE RAILWAY REVIEW

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EYE AND EAR EXAMINATIONS.—Some of the New York Central engineers and firemen who thought that the examinations made by the company's expert oculist in New York were simply a pretext under which to secure an excuse for the retirement of employes had a Syracuse oculist examine their eyes and ears before going to New York. The result was not very comforting, fully one-third of those examined being rejected. Very few had perfectly normal hearing, and fully 50 per cent were suffering from a partial paralysis of the auditory nerve, in consequence of continuous loud noises, the severe shaking to which they are exposed, the persistent straining of the ear, and the piercing draughts. The doctor who was consulted says that any occupation in which continuous noises act upon the ear is apt to impair the functions of the delicate portions of the auditory system. This is due to too great and too prolonged stimulation of the auditory nerve on account of the sudden condensation of sound waves on the drum membrane of the ear. The effect is similar to the fatigue of the optic nerve caused by prolonged exposure of the eye to direct sunlight, which if continued will lead to permanently impaired vision. Another symptom to which engineers and firemen are particularly liable is the condition known as tennitis aurium, a continual noise in the ear, which, as a rule, resembles the sounds with which they are most familiar, such, for instance, as the escaping of steam, the ringing of bells, and the workings of the air brake. The dangers of railroad traffic which arise from such aurial affections in engineers and firemen are very great, and it is for the public safety that such examinations are made compulsory.

ELECTRICITY IN SHIP BUILDING.—The application of electro-motors for the driving of machinery in ship yards and engine works promises to extend rapidly, thus providing an additional factor in the acceleration of the already rapid rate of production in these branches of industry. They have already been adopted to some extent in several of the largest Clyde yards and engine shops, and in one or two on the northeast coast of England. The rapidity of the work which has been done recently on several British battleships has been remarkable, and has been mainly due to the employment of electrically worked drills, slotting machines and other apparatus of a kindred nature. The application of electricity, however, has not in England assumed anything like the dimensions observable in German workshops and ship yards. At the Berlin Machine Works, for example, says the Marine Review, the tools and machines employed, which are of the latest patterns, are worked by electro-motors, which receive power from a central station. In the ship and engine works of Messrs. Blohm & Voss, Hamburg, which have been mostly rebuilt and reorganized within the past few years, there are electrically-driven hoists along side the building berths, electric (combined with hydraulic) power traveling cranes throughout the engine and boiler shops, and clever applications of the principle to various other machine tools. At the present time preparations are going forward for the laying down of a new ship yard at Nikolaiev, Russia, the machinery for which is to be almost entirely electrically driven, and is being made in Germany, Belgium and France.

A POWERFUL ELECTRIC MINE LOCOMOTIVE.—The Crozier Coal & Coke Co. of Elkhorn, W. Va., has just received the largest electric mine locomotive ever built. The locomotive was turned out by the Baldwin and Westinghouse concerns and was guaranteed equally well with steam locomotives of the Baldwin Locomotive Works. The locomotive was required to be of the six-wheeled connected type, to weigh 43,000 lbs., and was guaranteed to haul 40 cars at the rate of six miles per hour up a 2 per cent grade and develop a draw-bar pull of 10,000 lbs. while using sand. The sharpest curve has a radius of 60 ft., the rails weigh 40 lbs. per yard. The gage of track is 44 in. and the clearance through which the locomotive is to pass is 6 ft. 11 in. high above the rail, 10 ft. wide at the bottom and 8 ft. wide at the top. The following general data is given:

Diameter of driving wheels	33 in
Total wheel base	6 ft
Extreme width	6 ft. 2 in
Extreme length over all	18 ft
Weight in working order	43,000 lbs
Extreme hight	5 ft. 6 in

It is fitted with two 100 horse power consequent pole motors, with steel fields wound for 500 volts. The gears are cut and are of cast steel. The gear cases are of sheet iron, oil tight at the bottom, and completely surround the gears. The driving axles are of best hammered iron with journals 5½ in. in diameter by 6½ in. long. The driving wheels are of cast iron, spoke type, keyed to axles. The tires are of open hearth steel, 5 in. wide and 2½ in. thick. This locomotive has two sand boxes, front and back, two electric headlights with parabolic reflectors and brakes operated from both ends, one electric controller operated from both ends and suitable for two 100 horse power motors. All electrical apparatus, including rheostats, controller poles and switches, are provided to operate the locomotive. The workmanship is equal in all respects to that given to steam locomotives. All similar parts are interchangeable and all turned bolts have driving taper fits.

THE MANCHESTER SHIP CANAL.—The general manager of the Manchester Ship Canal Company is now in this country for the purpose of soliciting business for the canal. A circular letter has been issued setting forth the apparent advantage, at least, of shipping direct to Manchester instead of via Liverpool. The gentleman claims that with no reduction upon inland freight in America and with an even sea rate there will be an average saving on the whole New York cargo of 7 cents per 100 lbs., or $1.56 per ton in favor of Manchester; and $1.17 per ton saving on the New Orleans cargo. He does not explain where this saving comes in, except to say that delivery by cart to destination is included in these figures and that one week is allowed at the Manchester docks for the removal of freight from the quay sheds, as compared with three days at Liverpool.

SEA RAFTS NOT A SUCCESS.—The second log raft to successfully make the trip down the coast has reached San Francisco. As in the case of the one taken down a year ago, the weather was exceptionally favorable, as the ocean has been like a mill pond for weeks. Inasmuch as there are only rare periods when the waves are harmless, the success of this method of transferring timber is as yet rather limited. Two rafts have been lost and two have gone through in safety. A system that necessitates waiting a year for a favorable chance to operate it, can hardly be called a success.

A POWERFUL HIGH SPEED ENGINE.—The firm of McIntosh, Seymour & Company of Albany, N. Y., has just installed a four-cylinder upright triple expansion engine of 2,150 h. p. at the Jefferson mill of the Amoskeag Corporation at Manchester, N. H. The unusual feature in the design is that the engine was required to run at a speed of 232 revolutions per minute, which involved a number of important features of design which are quite different from ordinary practice. The high and intermediate cylinders are placed over and tandem with the two low pressure cylinders, the diameters being respectively 22½, 36, and 40 inches, there being two cylinders of the last mentioned diameter. The stroke is 22 in. The maximum capacity of the engine is 2,800 h. p., but the nominal rate of working will be 2,150. The reason for the high speed requirement is that the engine is to be used as an auxiliary to the water wheels and it is coupled to the main driving shaft of the mill. The valves are of the gridiron type. The receivers have heating coils of copper pipe carrying live steam from the boilers. The crank shaft is forged of nickel steel and has a 3 in. hole through it, the crank pins also being hollow. The piston rods are of nickel steel and are forged in one piece with the cross-heads. The connecting rods are of the marine type with forked ends and are lightened by having holes bored through them lengthwise.

WHY HE PATENTS HIS INVENTIONS—As Thomas A. Edison watched the pumping of air from a glass tube in his laboratory a day or two ago a man said to him: "You patent every little thing you discover, don't you, Mr. Edison?" "I do," said Mr. Edison. "And do you know why I do it?" "I suppose you do it so that you will reap the benefit of your discovery," was the reply. "I thought you'd say that," said Mr. Edison, "and I don't suppose you will believe me when I tell you it isn't so. Nevertheless, I discover a great many things that I would be very glad to give to the public for nothing, but I don't dare. I patent these things to save myself from defending lawsuits. There are a lot of sharks in this world who are continually on the lookout for good things, and when one of them hears of something new he hustles to the patent office to see if it is patented. If it isn't he claims it is an original discovery and files his claim. Then he will turn right around and, like as not, begin suit with the man who invented the thing for making or using it. The inventor will say: 'But I discovered this thing first; I am the inventor.' He is referred to the patent office, where he finds the official claim of original invention. The fact that the papers are filed long after he made his discovery does not help him, for all the other man does is to hire a fellow to swear that he made the discovery a month or two prior to the date the inventor claims. It sounds ridiculous, probably, but it is a fact that there are often races between the inventors and the sharks to reach the patent office, the sharks having had early information about the inventor's discovery. There are many such races, and thousands of dollars depend on each one."—[Inventive Age.

WIRED GLASS.—The tests of wired glass appearing in the June report of the Boston Mutual Fire Insurance Company indicate an unexpected use of this article in fireproof work. The building used in the experiment was an ordinary brick building 9 ft. high, provided on one side with a wire glass roof and roughened glass on the other, side windows, and a glass door with wooden frames lined with tin. The building was filled with rosin saturated wood to the hight of 6 ft. On firing, the ordinary glass cracked and fell at once, while the wired glass remained, notwithstanding the heat was so great as to crack the walls of the building. The theory of this glass standing the heat in this manner is that the glass under the first influence of heat, cracks but is held in place by the wires, but as the heat increases the glass becomes fused and again cemented together. Glass fusing at a lower temperature than the wire, and being a poor conductor of heat, each protects the other.—[Architecture and Building.

THE KRUPP WORKS AT ESSEN.—More than 1,250,000 tons of coal are annually consumed by the famous Krupp works at Essen, Westphalia, commenced in 1810 by Peter Friedrich Krupp, and now in possession of Herr Friedrich Alfred Krupp, member of the Reichstag. The establishment consists, according to the Eisen Zeitung, of two steel works with 15 Bessemer converters; four steel works with Siemens-Martin open hearth furnaces; iron, steel and brass foundries; puddling, melting, re-heating and annealing furnaces; draw benches; a hardening and tempering department; file manufactory; rolling mills for plates, rails and tires; railway spring and wheel manufactory; steam hammers, forges, axle turning shop, boiler shop, engineering and repair shops. Besides the above and many other departments at Essen, connected with the making of cannon there are steel works at Annen in Westphalia, three collieries in Westphalia, besides participation in several others; 547 iron mines in Germany; various iron mines at Bilbao, in Spain; four iron works, including one at Duisberg, one at Engers, one at Neuweid, and one at Sahn; various quarries of clay, sandstone, etc.; four steamers and artillery ground at Meppen, Hanover. The property owned extends over 974 hectares (hectare = 2.47 acres), and the number of hands employed in the mines and steel works is 25,301. There are altogether 1,500 furnaces of various kinds, 3,000 engines and machine tools, 22 roll trains, 111 steam hammers, 2 hydraulic presses, 263 stationary boilers, 421 steam engines, representing together a force of 32,139 horse power, and 430 cranes, having a collective lifting power of 4,662 tons. The total length of the shafting is 8.8 kilometers (5½ miles), and that of railways, standard and small gage, 85 kilometers (53 miles) worked by 32 regular trains with 33 locomotives. The annual consumption amounts to 1,253,161 tons, and there are 573 arc and 1,804 incandescent electric lamps.

A RAILWAY FOR KOREA.—Within a few months, unless some hitch occurs, will be begun the construction of the first railroad that has ever been built in Korea. It is to run from Seoul, the capital, to its sea port, Chemulpo, a distance of about 25 miles. The concession under which the railroad is to be built and operated was granted to an American citizen, and the road will be constructed with American capital and under the supervision of the American engineers. The president of the construction company was one of the first foreigners to enter the country, when it was first opened up in 1882, and has spent a number of years there. He is on terms of personal aquaintance with the King, and about a year ago he had the contract of placing an electric light plant in the sovereign's palace. He has recently obtained concession for the working of several gold mines in the interior, and has sent for engineers from this country to develop them. Under the terms of the concession the construction of the railroad must be begun before March 29 next, and the road must be completed within two years from that time, unless prevented by the existence in the country of a state of war or other unavoidable disturbance.

COAL FROM CHINA.—China has thrown down the gaunt let to the big coal miners of the United States. The American bark Colorado, which has just arrived at San Francisco, brought a mixed sample cargo of anthracite and other coal mined in the Tonquin district. It was consigned to a coal dealing firm of that city, which promises to push the Chinese fuel on the coast market at prices greatly below those which Pennsylvania and Welsh coals of the same character are now bringing. Examining experts have pronounced the Tonquin coal beds inexhaustible. The Chinese article is in the market to stay, it is said at least as long as the present tariff condition exists. Tonquin, since the Tonquin war, has been under the control of the French, and it is French capital that is now developing the mines, but the land is still populated by Chinese, as before, and it is the cheap Chinese labor that is employed in the mines; hence the extremely low cost of production which enables the French owners of the Tonquin mines to undersell the coal producers of other countries, where labor is better paid. The coal from the Orient is said to be of the finest quality, fully equal to the best Pennsylvania or Welsh coal.

A REMARKABLE CASE OF CORROSION.—A case of corrosion of marine engines was described at the recent meeting of the Institution of Mechanical Engineers at Belfast, Ireland. A steamer laden with "burnt ore" was sunk off the coast of Scotland, remaining under water for a week. When the vessel was raised, the machinery was found to present an extraordinary appearance, all wrought iron work being deeply corroded, and planed cast iron being so soft as to be easily cut with a knife. As engines are generally little injured by submergence, even for a considerable time, it was evident that there has been some unusual chemical action. The source of this was found in the cargo, burnt ore being the residue from the manufacture of vitriol from sulphur pyrites, and usually containing sulphates of copper and iron. These salts would react on the chloride of sodium of sea water to form sulphate of sodium and chloride of copper, either of which in solution dissolves wrought iron or cast iron.

Civil Engineers' Club of Cleveland.

A meeting of the Civil Engineers' Club, Cleveland, O., was held on Tuesday evening, September 8, at the rooms of the club, Case Library Bldg. Present 33 members and

visitors. The talk of the evening upon "Some Examples in Recent Roof Construction", was given by Mr. James Ritchie. The subject was thoroughly discussed by Messrs. Porter, Searles, Richardson, Hyde, Brown and others. Messrs. John McGeorge and Carl C. Thomas were announced as being unanimously elected to active membership.

THE AMERICAN SOCIETY OF RAILROAD SUPERINTENDENTS.

Last week an account of the meeting of the American Society of Railroad Superintendents was given in these columns, and abstracts from several of the reports are presented below. The committee on roadway selected the subject of "Tie Plates" as being of special importance with reference to maintenance of way. This report is so long that only the most important portions are reproduced. The report on "Motive Power" is also abridged, but that treating of "Transportation" is given in full:

TIE PLATES.

The requirements of a tie plate are, primarily, the preservation of the cross tie, and the importance of tie plates as a factor in their preservation and the formation of good track by restricting rail movements is well established. The growing tendency to higher speed of trains and heavier rolling stock is rapidly making the task of maintaining a proper kind of track more difficult and more expensive; and the rapid depletion of our forests by the unceasing and increasing demand for railroad ties, more especially hardwoods, and particularly oak, the high price of which in many sections of the country makes it no longer an economical tie to use, makes it necessary that this wood shall sooner or later be replaced by ties made of softer woods, either treated by chemical process to prevent decay, or by mechanical means to protect them from destruction by the mechanical action of the rail; and the tie plate is, so far, the best means that has been devised toward the accomplishment of the latter result.

The several different designs of tie plates that have been used in this country are more or less familiar to you all, such as the "Servis," the "Goldie," the "C. A. C.," the "Walhaupter," etc. These have also been used to some considerable extent in Canada and Mexico, but information is lacking as to the forms of plates used in other foreign countries. An effort has been made to ascertain as far as possible what form of plate is best adapted to American railroads, regardless of any particular form now in use, whether or not all of the elements necessary to the desired results are embodied in one plate, or form a part of the composition of many. The qualities necessary in a tie plate to fulfil the service it is called on to perform may be generally stated as follows:

1. Adhesion to the tie, so that it may be considered as practically a part of it, preventing damage to the wood fiber and rattling by passing trains. 2. Adhesion to the tie to prevent its lateral movement, even on curves of high degree, so that the track cannot spread. 3. The above vertical and horizontal adhesion to be obtained by such a mode that it will not assist decay of the tie. 4. It should be so constructed that its application be simple and economical. 5. Its cost should be sufficiently low, so that, when added to the total cost of the tie in place, it will by sufficiently prolonging the life of the tie, pay for itself, due allowance being made for a saving in labor on track repairs and a better condition of track.

The fulfilment of these requirements should, 1. Prevent damage to the tie by the rail cutting into it; 2. Make the use of rail braces unnecessary; 3. Make possible the use of soft wood and longer lived ties on curves as well as on tangents, and on all conditions of track; 4. Make possible the use of a tie in the track during its natural life under the most trying conditions of alignment, grade and traffic; 5. Greatly reduce the expense of maintenance of track to proper line and surface; 6. Make possible the maintenance of track in a safer condition, and afford relief to our forests of tie producing timber.

As to how these results may finally be obtained, investigation shows that enough experience has not been accumulated on which to form a decided opinion. A circular embodying questions was sent on May 29th, 1896, to each active and associate member of the society, and also to a number of officials of roadway and engineering departments of large systems, who are not members of the society. The replies are in such varied form that it is not possible within the limits of this report to give them in detail, but we have selected from them such information, and have quoted the accounts of such experiences as we believe will be of most interest.

The total number of replies received was 73, in which 24 stated that they had not used tie plates, and were therefore unable to express any opinion at all, and 49 had used them to a greater or less extent. The number of tie plates of each kind in use was not in all cases given, and we have no accurate figures as to how many there are. Several large systems of this country and some foreign roads using tie plates have not been heard from. Only four systems that we have learned of have adopted tie plates for use on their entire lines, one western road having nearly 3,000,000 Servis plates in use, principally on California redwood ties, also on cedar and some Burnettized pine and fir. Another has 250,000 Servis plates on cedar ties, and another 293,000 Servis plates on California redwood, each of these systems having had them in use extensively from two to six years, while their total experience extends over various periods of from seven to ten years. A system in Massachusetts has had 300 miles of road equipped with plates for six years, the number in use being divided between the Servis, C. A. C. and Goldie, about equally. Valuable information was received from one southern line that has had 40,000 plates in use for four years, consisting principally of Servis and Goldie with a few Walhaupter, the kind of ties on which used not being stated, but presumably oak.

Accounts were given of the use of 300,000 Servis plates during the past 18 months on another prominent southern road, and of some extensive experiments with Goldie and Servis plates on one of the northwestern trunk lines, but the majority of those replying to the circular report experiments with all of the different makes, more or less, without showing how many of each kind are in use. As a matter of information, it may be well to state that, where the number of plates in use was specifically stated, the aggregate number of each kind was as follows: Servis, 4,565,000, Goldie 1,000,000, C. A. C. 600,000; however, these figures are of uncertain value, for the reason that they do not represent all of the tie plates in use; yet they indicate a more general use of the form having longitudinal ribs entering the tie parallel with the grain. These inaccurate figures could hardly be used as an argument for or against any particular form of tie plate, and are only given for what they are worth.

It is observed that where a very positive preference is expressed for a particular kind of plate, it is often the case that no experience has been had with any other form, which is a good argument for tie plates in general, but not a strong one for the superiority of one form of plate over the other. There are some notable exceptions, however, where, after having made extensive experiments with several kinds of plates, one particular form has been finally adopted. These cases are deserving of the most serious consideration.

By far the most important feature of a tie plate is the means by which its contact with the cross-tie is maintained, and, naturally, on account of the different means employed in the various makes of plates, there is more diversity of opinion as to this feature than any other. The question is mainly, whether the union of the plate with the tie shall be secured by ribs entering the tie parallel with the grain, or by lugs or claws entering the tie at right angles to the grain. Of the 44 opinions received on this point, 28 declare their unqualified preference for the plate with longitudinal ribs, 8 are equally positive in their preference for the other form, 3 appear to be as well satisfied with one as the other, and 5 have not yet formed a positive opinion either way.

Some of the principal arguments advanced in favor of plates with longitudinal ribs are as follows: That it adds materially to the stiffness of the plate. That it excludes water, etc., from between the tie and the plate because of a closer adhesion; that it does not weaken the tie by cutting the fibre; that it is "more easily adjusted."

Some of the opinions are as follows:

"The track can be rearranged better and at less cost with plates with longitudinal ribs than with plates which cut the fibre at right angles." "Where the ribs enter the wood parallel with the grain, they simply push the fibre to one side in entering. The fibres immediately begin to close up around the ribs, and in a short time the iron ribs and the fibres of the wood adhere so closely that the plate cannot be pulled out of the tie without bringing some of the wood fibres with it. On the other hand any projection entering the wood across the grain cuts the fibres, leaving a gaping hole which never closes up, and the plate can always be easily removed from the tie, and in fact, is apt to be loose and rattle at any time. This can be very simply and clearly shown by an axe. If a sharp axe is driven into the tie across the grain to the depth of one inch and left there, it will be very apt to fall out of itself in a short time, but if it is driven to the same depth parallel with the grain and left there a day or two, it will be hard to pull out."

"1: The ribs entering the tie do not cut the fibres, but simply compress them, and these compressed fibres are continually re-acting on the ribs, thus holding the plate firm." "2: The weight of trains on these does not tend to elongate the fibres, but to spread them laterally. This increases the pressure of the wood against the longitudinal ribs, and keeps the plate and tie permanently bound together." "3: When the tie begins to decay (when the plate is of most service), the longitudinal flanges hold the soft fibres of the wood together, thus prolonging the usefulness of the tie." "4: The longitudinal flanges give a better distribution of a given amount of metal for strength, and allow plates to be made thin enough for elasticity."

On one other hand, one superintendent expressed the belief that the tendency of the longitudinal ribs is to split the tie, but this theory is not supported by any argument, that we have seen. It is claimed by those who prefer the tie plate with lugs or claws cutting the fibre at right angles than they are more easily applied than the other kind; and it may be noted that this same claim has been made for both forms.

As to whether or not a tie plate should have a shoulder on the outside of rail to relieve the spiking, and assist in maintaining the gage, it seems to be the most general opinion that such a shoulder is desirable, although a large number of engineers and other officials who have used plates with no shoulders are of the opinion that it is unnecessary. It does seem, other things being equal, that a plate with a shoulder on the outside of rail, and especially one with a shoulder extending entirely across the plate, would do more toward keeping the track in gage and lessening the wear on spikes than one without such a shoulder, and that a plate so constructed would be of particular benefit on curves. The statement is made by some that a plate without a shoulder at all is not a complete rail brace, "as the fibres of the tie are too soft to offer sufficient resistance to the spreading of gage;" however, this opinion may have been expressed with only a view of using ties made of soft wood. Only a few superintendents claim that rail braces cannot be entirely be dispensed with on sharp curves, while it is the most general opinion, so far as we are able to learn, that tie plates fully perform the functions of a rail brace, and are in fact an improvement on them. For instance, one states that "they are very effective in preserving gage and saving spiking on account of ribs (uses the Servis combination plate) entering the tie and furnishing sufficient resistance so that the track in which we have laid four consecutive ties with plates without spiking on a nine degree curve with a five inch elevation, the gage was perfectly preserved." Another states that he "considers them better than braces, as the plate holds the rail perpendicular, and makes a more uniform surface wear, and so prevents scaling, prevents the rail spreading, which, with 60 ton engines on curves at fast speed, is not overcome by braces on every second tie on curves of eight degrees and over, and on every third tie on curves of less than eight degrees."

A very clear explanation of the action of a rail brace, as well as a good argument in favor of tie plates was given us by Mr. J. A. Dodson, of the Southern Railway. "The centrifugal force exerts a strong pressure on the head of the rail, tending to revolve it about the outer edge of its base. This unequal bearing of the rail on the tie, combined with the sawing or abrasion of the tie from the rail flexure as each wheel passes over, soon depresses the outer edge of the rail into the tie, thus destroying its vertical position. This is a tendency which may be retarded, but cannot be counteracted by a rail brace; a rail cannot turn over until the outside of the base is lower than the inside. When the tie becomes cut at the outer edge of rail base, the brace is forced into the tie at its edge nearest the rail and slightly draws the spike at the side remote from the rail. When such condition is reached, which does not require any considerable length of time, the flange of each wheel begins to shave the head of the rail on the gage side, which is destructive to both rail and rolling stock. The only remedy is to draw all the spikes, adze the tie and prepare for a repetition of the same trouble. By using tie plates, the cutting of the tie is stopped, the rail is maintained in an upright position to gage, and all trouble from this source vanishes. The saving in ties, rail, wheels, spikes and labor is considerable, sufficient to pay for the tie plate several times."

As to the effect on spiking, there appear to us to be reasons why a plate with a shoulder should be more beneficial than one without it, provided the plate is so constructed that the only function of the spikes that is left is that of holding the rail down to the ties. There can be no doubt, however, that any of the plates in question, either with or without a shoulder, will have a beneficial effect on the spiking, as the punched holes of the tie plate insure the spikes being driven vertically, for men will naturally exercise more care in starting and driving them; first, because the plates require it, and second, because improper spiking is more easily detected if the spikes are not driven vertically, and any attempt to straighten the spikes by hitting them with a maul will only make matters worse. The spike holes, however, should be of such a size and position that the spikes shall fit the rail flange snugly in order that the spike heads shall have the proper hold on the rail. On some roads where plates having no shoulders are used, three spike holes are punched so that two spikes can be used on the outside of rail, with very satisfactory results as to keeping the track to gage. No considerable use seems to have been made of plates of a bevel or wedge shaped form, but some manufacturers have recommended them "to give the rail an inward inclination and at the same time increase the thickness of the plate at the shoulder, thereby increasing its stability, and reduce the flange wear of the rail heads."

One official reports having used such plates, but says that at present they are using the Servis plate both on curves and tangents, considering it for all purposes as good as the wedge shaped plate. One or two members have recommended a plate with a bevel of from 1-16 to ⅛ of an inch.

A very few objections have been received against the use of tie plates on heavy grades, the possibility of bad results being suggested from the "reducing of friction contributed to the rail running down hill." One suggests that "if spikes are allowed to raise, the rail would creep more readily on a steel plate than on wood, and where the force is small, spikes will work up," but it is not probable that there is much foundation for such an objection.

As before stated, it may be properly said that all of the different forms of plates mentioned above have their good points, but it would not be safe at this time, considering the comparatively short experience that has been had with them to condemn or to approve of either kind. It is possible, as was before suggested, that no one form of plate yet devised will give perfect results under all conditions, yet it appears that a plate combining longitudinal flanges entering the tie parallel with the grain and a shoulder on the outside of rail, would be most desirable. That tie plates, as one of the most important features of track equipment, have come to stay, there is no doubt; and that they are of special value on sharp curves and heavy grades; in tunnels, particularly where wet and where the difficulty of securing good track is great because of the softening of the ties by the action of water, gases, etc.; in yards where there is constant switching and heavy traffic; at platforms in front of stations, and in street crossings where the ties are kept soft by moisture, and where it is both difficult and expensive to get at the track for renewal of ties, re-surfacing or re-gageing; on bridges and trestles, particularly those on curves, and on grades where a great deal of sand is used and where

traffic is very heavy. It is possible that in the southern states where oak ties are plentiful and cheap, their use on tangents might not be justifiable, but in the north and west where only soft ties are to be had, or where the price of ties is high, their general use on all kinds of track seems desirable.

The following extract from a very interesting communication from the chief engineer of one of our most important railroads is worthy of consideration:

"There are I believe, very few roadmasters who, if they were asked to choose for general use, between 60 lb. rail with tie plates and 75 lb. rail without tie plates, would select the latter. The cost is about equal."

We have not attempted to go very deeply into the question of the cost of tie plates, being more particular to consider their mechanical features. Their cost, of course, largely depends on their weight and dimensions and the number used, ranging from 5 to 15 cents each; but we think it would be more proper for those desiring information of that kind, to obtain it from the manufacturers themselves.

Finally, we are aware that we have by no means completely covered this subject and that it will bear a closer investigation than we have been able to give it, but it is probable that only future experience can fully determine what we desire to know about tie plates.

SEELEY DUNN,
A. W. JOHNSTON,
M. J. C. WRENNE.

REPORT OF COMMITTEE ON TRANSPORTATION.

At the last meeting of the society the committee on transportation made a partial report on the subject assigned viz., "Special instances of economy in the handling of freight service," the particular topic under that heading being the tonnage standard for loading freight trains.

Your committee has not been able to hold a meeting during the past year, but through correspondence it was arranged to send out to the various members of the society a circular containing interrogatories as to their method of loading trains, whether by the tonnage system or by the car system. From over 200 members only 52 replies were received. Of 52 roads represented, 22 were loading trains by the tonnage method, the balance were not. From the replies received from the members on whose roads the tonnage system is in vogue, it is clearly shown that large savings can be made by use of the tonnage system. The percentage of increase shown in tons or cars per train by reason of the use of the tonnage system varies 3 to 20 per cent. The use of the tonnage system in five cases reported has served to increase the average speed of trains. In the other cases reported the speed has either decreased or no change has been noted. In a majority of answers it is shown that the tonnage system of loading trains gives greater uniformity of movement and avoidance of overloading of trains. Reports show that there is a large field for improvement in systematic effort tending to increase the number of tons of freight per car. One member reports that he has made an increase of from 12 to 15 per cent, which is a remarkable showing.

We therefore recommend the use of the tonnage system in loading trains in preference to the car system, and the question of the loading of cars to full capacity is one that deserves close attention and will give very gratifying results.

T. F. WHITTELSEY,
E. F. KNIBLOE,
C. E. DOYLE.

REPORT OF COMMITTEE ON MOTIVE POWER.

We have arrived at a very interesting point in the evolution of railway motive power, a point of transition from old methods and theories to new ones, a point from which it seems possible to almost certainly predict the entire change from steam to a more economical motive agent. Already the electric motor appears as a formidable competitor of the steam locomotive in suburban and inter-urban traffic in many parts of the country, and he who brings himself to believe that the application of electric power for transportation purposes will never get beyond this class of traffic has a very narrow vision of the field of progress.

The science of electricity is still in its infancy. Electricity itself is a subtle something which cannot be accurately defined, but, as little as is known of the thing, enough is known of its properties to enable men to recognize it as an ideal motive power, and, having brought this wonderful agent, this mysterious force which exhibits so many desirable properties from an economical mechanical standpoint, so far under his control as is represented by its present uses, man is not going to stop at that. He will go on experimenting, inventing, improving and perfecting until the process is discovered whereby the wonderful properties of electricity shall receive their fullest economical application. And such application is bound to cover the entire field of present motive power, besides an extension into fields as yet but dimly dreamed of. This is inevitable. To believe otherwise is to lose faith in progressive development. Unless, then, we make the assumption that we have reached the end of progressive development, we must admit the very great probability of the entire suppression of steam by electricity as a motive power on our railways, not only in suburban and inter-urban traffic, but in cross-co untry traffic also.

Primarily, such change will take place because the perfection of economy has probably already been reached with regard to the application of steam. We have every reason to believe that the steam locomotive of the present day represents the perfection of economy in its peculiar field, or very nearly so, as there are no valid grounds for believing that the application of the principle of compounding will work much of a revolution in economical locomotive practice, and there seems no other direction in which to look with any degree of confidence for a further economical application of steam power.

There is a wide chasm between the actual and the theoretical economy of the steam locomotive, and it is a chasm which the highest talent of the entire civilized world has for many years been trying to bridge. The effort has resulted in the production of a wonderfully perfect mechanism, the modern locomotive. A machine which performs wonders that would have been set down as the tales of a romancer less than half a century ago. But, in spite of its perfection, the modern locomotive is far from being an economical machine when judged by the standard of the theoretical, and the very fact of its perfection is the sign of its doom. There still remains this chasm to bridge, and there still remains the inventive faculty of mankind which is striving to bridge it.

As long as there was any possibility of improvement in the steam locomotive, man's inventive faculty concentrated itself there, and by every possible means endeavored to attain the theoretical point of economy with the aid of the agent, steam. But now the time is at hand when the limitations of steam have been fully recognized for all practical purposes. The limit has been reached. But the perfect application of steam still falls far short of the goal strived for; that is to say, the perfect machine is actuated by a force which has properties that do not admit of the highest economy. Man's inventive faculty, therefore, must turn to this new force which has properties that promise a greater economy in its application to motive power and strive to invent and perfect the machine which shall control and apply it. It seems just as certain that the perfect electric motor will be evolved from the present conditions as it is certain that the perfect steam motor has been evolved from the conditions which were present fifty years ago.

The 35,000 steam locomotives on our railroads, representing a capital investment of at least $250,000,000 are not to be consigned to the scrap heap on an uncertainty, nor even in a hurry. Before the new power has the slightest chance to supersede the old, it must positively prove itself the economic superior of the old, and the demonstration of this economic superiority necessarily carries with it full compensation for all apparent losses that may be incurred.

Progress has its own law of compensation for all apparent evils which evolutionary conditions bring to the surface, and it is a law that all arrangements of this character must submit to. Before a new form can supplant an old one, the new must prove itself the superior of the old beyond any question of doubt; it is merely the application of the principle of natural selection to economic development. The process of change is necessarily deliberate and gradual, giving plenty of time for men to adjust themselves to the new conditions and furnishing the incentive to obtain all possible good out of the old form before it is abandoned. In the meantime, we have problems of compensation to meet, problems that are forced on us by the advance of the electric motor, that will require all of our ingenuity and skill to enable us to deal with. We shall be compelled to meet these problems with our present resources as long as possible, and manipulate our present instruments for all they are worth, until their insufficiency has been absolutely demonstrated. When that time comes, there will be nothing left for us but to change to the new instruments and enter the field of competition on equal terms. It stands us in hand, then, to keep pace with the development in the science of electrical engineering, so as to be fully prepared to act intelligently on the changes that force themselves upon us, whenever it so happens that those changes are demonstrated to be unavoidable

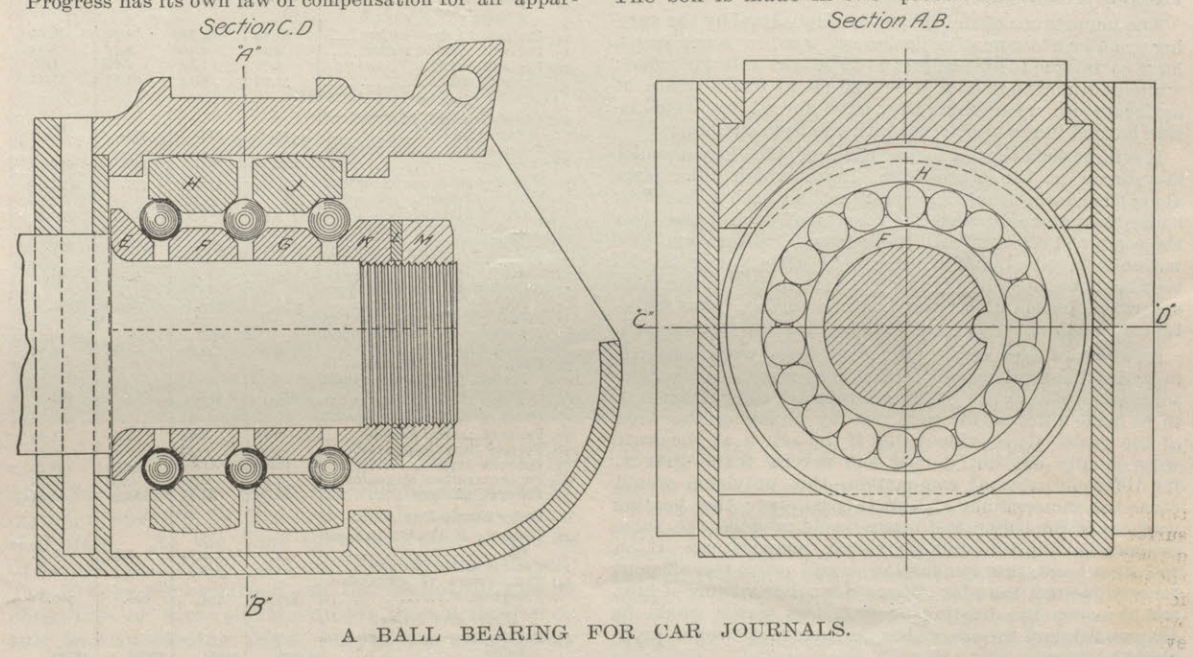
W. F. POTTER, Chairman.
J. K. V. AGNEW,
A. J. HITT.

A recent report on German railways states that in eleven years (1885-95) the empire has seen its railways increased from 22,704 miles to 27,445 miles—an increase of 4,741 miles. In 1885, 18,915 miles belonged to through or principal lines, with 3.789 miles branch lines; while in 1895 19,658 miles were on through lines, with 7,787 miles on side lines. The total length of rails in 1895 was 48,155 miles, an increase of 10,626 miles over 1885 and 967 miles over 1894. There were in 1895, 9,457 miles of double-track lines and 17,988 miles of single track lines—a ratio 1.9 to 1 in favor of single track lines. In 1885 the ratio was 2.4 to 1, hence in the last ten years the double track has found favor. There are 66 miles with three tracks and 41 miles with four sets of lines.

A BALL BEARING CAR JOURNAL.

The accompanying illustration shows the construction of a new ball bearing journal and box recently designed and patented by Mr. W. M. Shumway of Chicago who was formerly for a number of years connected with the civil engineering department of the Chicago & Northwestern Railway. This bearing consists of a hardened steel collar E securely keyed to the journal. Two collars indicated by F and G are arranged so as to be movable longitudinally on the journal, but which are made to rotate with it by means of a feather or key. Collars H and J are confined loosely within the oil box and are separated from the collars E, F, G and K by rows of balls. The collar K is screwed on to the end of the journal, which is threaded for the purpose and forms one of the bearing surfaces and also the adjusting nut by which looseness or play in the bearing may be taken up. This adjusting collar is locked in position by means of a washer which carries a feather which prevents it from turning on the axle, and outside of this feather is a lock nut. The latter member is prevented from leaving its position by a cotter. The rings upon which the box bears are made rounding on top for the distribution of the load when passing over uneven spots in the track.

The oil box as shown in the illustration is not interchangeable with the M. C. B. standard; but there seems to be no reason why it cannot be made so. The box is made in two pieces which are held in position by the pedestal jaws and may be readily removed by jacking up the car body slightly. The plan for lubrication is to fill the box with oil to such a level as to cause the balls to dip down into it at the lowest point in their revolution around the journal. The design shows balls one inch in diameter which are to be of hardened steel. There are 18 balls in each row, making 54 in all, and it is stated that Simond's steel balls of this diameter have not been crushed with a load of 50 tons. The design is carried out with a view of resisting 5-9 of the total load of the car by the top row of balls which is a condition more severe than any expected to be found in practice. The working loads are based upon 2000 pounds for each ball with a car of 100,000 lbs. capacity. The arrangement of the balls and rings is such that in the case of broken ball, the pieces will be likely to drop out between the rings and cause no damage to the bearing. The rings and collars are made of hard carbon steel carefully tempered, their bearing surfaces being turned at an angle of 45 deg. to the axis of the journal. This is done with the object of eliminating sliding friction between the balls and the collars by bringing the axes of the balls parallel to the axis of the journal.



A BALL BEARING FOR CAR JOURNALS.

Among the claims made for this bearing are that it will prevent hot boxes, will reduce friction, save wear on axles, and that it will require no care, in operation except that necessary to keep it in adjustment. The results of practical tests with it will be awaited with interest.

THE EFFECT OF HIGH RATES OF COMBUSTION UPON THE EFFICIENCY OF LOCOMOTIVE BOILERS.

The experiments with which this paper is concerned were carried out a few months ago in the locomotive laboratory of Purdue University. They are here presented by a brief and very general description of the work, together with a discussion of some of its most significant results, and by two appendices (from which the accompanying diagrams were taken) which give the more technical description.

The problem to be studied by means of the experiments will be more readily appreciated if it is remembered that the boiler of any given locomotive is most efficient when worked at the lowest power practicable; that is, when the rate of combustion in its fire-box is minimum. For the development of a higher power, the rate of combustion must be increased, and as a result, the efficiency of the boiler is lowered.

The relation between the rate of combustion and the weight of water per pound of coal for the Purdue locomotive "Schenectady" while using Brazil block coal, is shown by Fig. 1. From this diagram it appears that when coal is burned at the rate of 50 lbs. per square foot of grate per hour, 8 lbs. of water are evaporated for each pound of coal; while if the rate of combustion is increased to 180 lbs. per square foot of grate the evaporation falls to about 5 lbs.—a loss in water evaporated per pound of coal of nearly 40 per cent. This loss may be due to a failure of the heating surfaces to absorb properly the increased volume of heat passing over them, or to the imperfect combustion of the fuel upon the grate, or it may be due to a combination of these causes.

That a portion of the loss occurs along the heating surfaces hardly admits of question, since it is well known that any increase in the rate of combustion results in a rise in the temperature of the smoke-box gases; but whether, under ordinary conditions, any considerable portion of the loss shown by Fig. 1 is due to imperfect combustion, has not been demonstrated and it is this question especially that the present paper attempts to treat.

The importance of the subject is emphasized by the varying practice of locomotive designers, who, in some cases, have so designed large boilers as to allow a large grate; while in others they have been content to use a grate of moderate size, upon which they have forced the combustion beyond limits which had hitherto been customary.

It will be seen that a separation of the losses which may occur at the grate from those which take place along the heating surface, could not be accomplished by boiler tests alone, because the results of such tests give the combined effect of both these losses. There are two variables involved, and in order that either may be determined one must be given a constant value. In the tests described, action along the heating surface was maintained constant, while conditions at the grate were varied.

As a preliminary step, a number of tests were outlined in which the total weight of fuel fired was to be constant throughout the series, while the rate of combustion was to be made different for each test by changing the area of the grate. It is evident that if the action at the grate were equally efficient during the several tests—that is, for different rates of combustion—this provision would cause the same volume of heat to pass over the heating surfaces of the boiler, and hence would produce the same evaporation and the same smoke-box temperature. If, on the other hand, the combustion should prove less efficient for any one test than for others, a smaller volume of heat would sweep the heating surface, less water would be evaporated, and the smoke-box temperature would probably be lower.

The outline provided for all observations usual in boiler testing, and, in addition to these, for a determination of the weight of fuel lost in the form of sparks, and for chemical analyses of the fuel used, of the sparks caught and of the smoke-box gases.

The first test was run with the locomotive under normal conditions. The whole grate was covered with fuel, the throttle was fully open, the cut-off approximately 6 in. and the load such as to make the speed 25 miles per hour. These conditions gave a rate of combustion of 61 lbs. of coal per square foot of grate per hour. In preparation for the second test, one-quarter of the grate was made non-effective, or "deadened" by a covering of fire brick. The exhaust tip was reduced, so that, while the engine was running as before and using approximately the same amount of steam, the same total weight of fuel could be burned on the reduced grate as in the first test had been burned on the whole grate. Trial tests were run until it was known that changes made would permit the desired conditions to be maintained. The rate of combustion in this test was 84 lbs. per square foot of grate area.

In preparation for the third test, the grate surface was reduced to half its original area, and the rate of combustion was increased to 124 lbs. per square foot of grate area; and during the fourth test only, one-quarter of the original grate was used, the combustion in this case rising to 241 lbs. per square foot of grate surface.

It should be evident from what precedes, that the prescribed conditions were designed to make each test a duplicate of every other test, excepting in the matter of grate area, this being the one variable for the series.

The coal used in the several tests was of uniform quality the chemical analyses showing no greater variation than might occur in different samples from a single shipment. The maximum weight of coal fired per hour in any test was 1,087, and the minimum was 1,038, a difference of less than fifty pounds in more than a thousand, while the variation during three of the four tests does not exceed 1.2 per cent of the weight fired. All firing was done by one man, the attendents engaged in taking the more important observations were the same for all tests, and all external conditions affecting the action of the boiler were uniform throughout the series.

The one variable for the series—namely, a different rate of combustion—was secured by keeping constant the weight of coal fired and by varying the area of the grate. There were burned each hour on each square foot of effective grate surface, 61 lbs. during the first test, 84 during the second, 124 during the third, and 241 during the fourth. These values more than cover the entire range of rates usual in locomotives.

OBSERVED AND CALCULATED DATA.

	1	2	3	4
1. Test Number				
2. Month and day (1896)	Feb. 8.	Feb. 11.	Feb. 15.	Feb. 22.
3. Duration of test, hours	6.	6.	6.	6.
4. Approximate portion of whole grate used	Full.	Three-fourths.	Half.	One-fourth.
5. Exact area of effective grate, square feet	17.50	13.01	8.74	4.31
6. Barometric pressure, pounds	14 41	14.43	14.34	14.47
*Analysis of Coal.**				
7. Per cent. fixed carbon	49.65	51.84	51.09	51.59
8. Per cent. volatile matter	40.29	39.00	38.93	38.87
9. Per cent. combined moisture	3.15	3.62	2.35	3.44.
10. Per cent. ash	6.91	5.54	7.63	6.10
Coal [Brazil Block].				
11. Pound fired	6522.	6628.	6716.	6328.
12. Weight of water in each pound of coal fired	0.012	0.016	0.030	0.012
13. Pounds of dry coal for test	6443.	6522.	6514.	6227.
14. Pounds of dry coal per hour	1074.	1087.	1086.	1038.
15. Pounds of dry coal per hour per square foot of grate	61.4	83.5	124.2	240.8
16. Pounds of combustible for test	5792.	5921.	5856.	5635.
17. Percentage of fixed carbon in coal, dry and free from ash	56.	57.	57.	57.
18. Approximate number of B. T. U. per pound of combustible	13800.	14040.	14040.	14040.
19. Approximate number of B. T. U. per pound of dry coal	13000.	13000.	13000.	13000.
20. Theoretical evaporation from and at 212° per pound of dry coal	13.46	13.46	13.46	13 46
Ash.				
21. Pounds of dry ash in ash-pan for test	446.	396.	297.	164.
22. Pounds of ash in coal fired as shown by analysis of coal	445.	361.	497.	380.
23. Pounds of ash by analysis, minus pounds found in ash-pan	—1.	—35.	200.	216.
*Analysis of Sparks.**				
24. Per cent. of fixed carbon	61.74	64.88	71.32	76.44
25. Per cent. volatile matter	4.36	4.16	3.45	3.29
26. Per cent. combined moisture	1.82	1.82	1.66	1.86
27. Per cent. ash	32 08	29.14	23.57	18.41
Sparks.				
28. Pounds caught in front-end during test	75.	213.	494.	566.
29. Pounds passing out of stack for test	294.	358.	278.	492.
30. Total pounds of sparks for test	369.	571.	772.	1058.
31. Pounds of sparks per square foot of grate per hour	3.5	7.3	14.7	41.0
32. Pounds of combustible in sparks for test	242.	395.	576.	857.
33. Percentage of fixed carbon in sparks dry and free from ash	94.	94.	95.	96.
34. Approximate B. T. U. per pound of sparks	9870.	10360.	11200.	11880.
35. Pounds of coal equivalent in heating value to one pound of sparks	0.75	0.80	0 86	0.91
36. Pounds of coal equivalent in heating value to total weight of sparks for test	277.	457.	664.	963.
*Analysis of Smoke-Box Gases.**				
37. Per cent. carbon dioxide	5.25	6.25	4.80	1 80
38. Per cent. heavy hydro-carbons	0.50	0.40	0.40	0.50
39. Per cent. oxygen	12.15	11.80	14.60	18.70
40. Per cent. carbon monoxide	0.00	0.00	0.00	0.55
41. Per cent. nitrogen	81.90	81.55	80.20	78.45
Other Smoke-Box Data.				
42. Diameter of Double Exhaust tip	3.	2.75	2.35	1.75
43. Draft in inches of water	2.2	2.5	3.3	5.6
44. Temperature of smoke-box, degrees F	647.	629.	610.	500.
Water and Steam.				
45. Pounds of water delivered to boiler	44756.	43081.	40710.	43770.
46. Temperature of feed, degrees F.	54.0	53.0	53.5	52.7
47. Boiler pressure, by gage	129.4	127.2	127.2	129.1
48. Quality of steam in dome	0.982	0.981	0.984	0.983
Evaporation.				
49. Pounds of water evaporated per pound of dry coal	6.94	6.60	6 30	5.58
50. Equivalent evaporation from and at 212° F	8.26	7.87	7.52	6.67
Horse Power.				
51. Horse power of Boiler	257.	248.	226.	201.
52. Horse power per square foot of grate	15.	19.	26.	47.
Approximate Efficiency.†				
53. Ratio of heat developed in the furnace to heat absorbed by water	0.61	0.59	0.56	0.50

* All chemical analyses were made under the direction of Professor W. E. Stone. Charles D. Test. A. C.

† The efficiency is approximate only, since the heating value of the coal is only approximately known. Since the same coal was used for all tests there can be no error in using this factor for purposes of comparison within the limits of the present series of tests.

Evidence of losses at the grate with increased rates of combustion is to be found in the record of water evaporated per pound of coal, which, for the several tests is as follows:

		1	2	3	4
1.	Number of test				
15.	Rate of combustion; pounds of coal per foot of grate surface	61	84	124	241
50.	Equivalent evap. from and at 212 deg. F.; pounds of water per pound of coal	8.26	7.87	7.52	6.67
	Loss of evaporation in terms of the evaporation for test No. 1		4.7	9.0	19.2

In consideration of all the conditions governing the experiments, it would seem fair to assume that the decrease of 19 per cent in the weight of water evaporated, a result

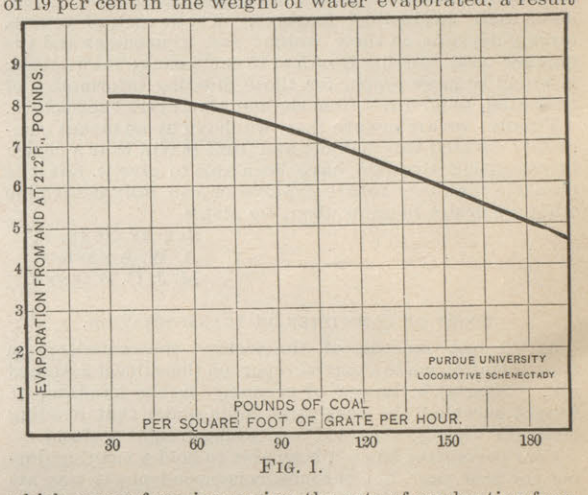


FIG. 1.

which comes from increasing the rate of combustion from 61 to 241, is a loss which occurs wholly at the grate.

[The fact that the plan of the tests did not allow the boiler to develop the same power during all tests, may give rise to a question concerning the accuracy of this statement; it may be said that a portion of the effects produced is due to changes in power. Against such an objection, it may be urged that changes in power were comparatively slight, and it can be shown that their influence would diminish, rather than increase, the difference in the observed results. It is, therefore, safe to say that the losses at the grate are not less than those given.]

The preceding paragraph exhibits a measure of the loss which occurred at the grate of the boiler tested, when the rate of combustion was increased above 61 lbs. A large fraction of this loss is to be accounted for by the escape of sparks, and it is significant that, as the sparks increase in volume, their heating value also increases.

By reducing the weight of sparks to an equivalent weight

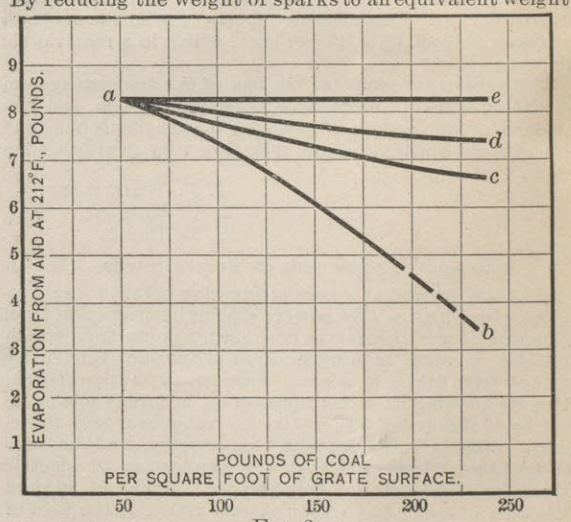


FIG. 2.

of coal, on the basis of their relative heating value, it is possible to make the following comparison.

		1	2	3	4
1.	Number of test				
15.	Rate of combustion	61	84	124	241
14.	Total lbs. of coal per hour	1.074	1.078	1.086	1.038
	Total lbs. of sparks per hour	61.5	95.1	128.6	176.3
	Pounds of coal equivalent to spark losses per hour	46	77	111	161
	Value of spark losses in per cent of coal fired	4.3	7.2	10.2	15.5

According to popular judgment, the loss of heat by sparks has always appeared small; while the data show that, under conditions which are now common, it may rep

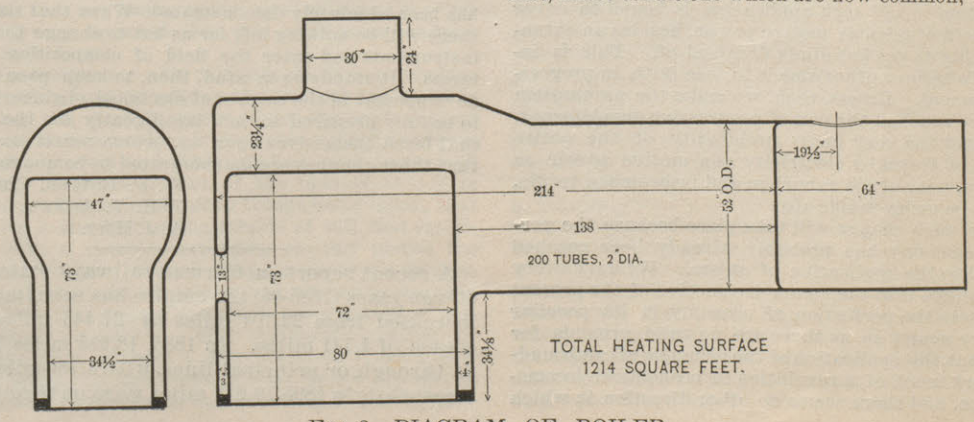


FIG. 3.—DIAGRAM OF BOILER.

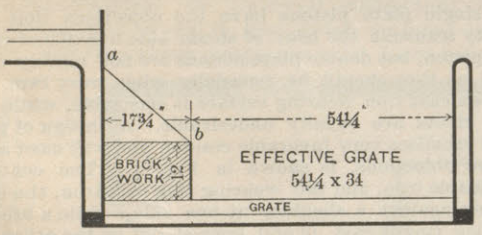
resent more than 10 per cent of the fuel value of coal fired. It is evident, however, that these losses will in general depend verymuch upon the quality of coal,and it should be noted that the Brazil block which was used in the tests under consideration is quite friable.

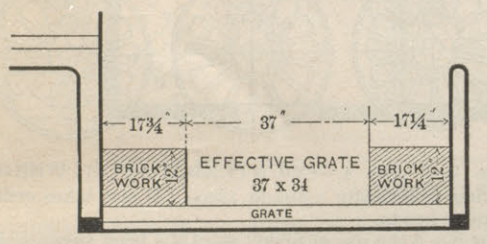
Without attempting a full discussion of the analyses of the smoke-box gases attention may be directed to two important facts. These are, first, the large percentage of oxygen shown, indicating a supply of air greatly in excess of that required for combustion; and secondly, the absence of carbon-monoxide (C O) in all excepting the last test.

All air admitted to the furnace in excess of that required for combustion is heated from the temperature of the atmosphere to that of the smoke-box, and by this process heat is taken from the furnace. As the data show an increasing amount of air during the third and fourth tests of the series, it would appear that this cause must have operated to reduce the performance of the boiler as the rate of combustion was increased.

The presence of carbon monoxide (C O) in the smoke-box gases is accepted as proof of imperfect combustion. This gas as already noted occurs only in test No. 4. It has long been supposed that its formation is due to thick firing, and its failure to burn after it is formed, to deficient air supply, or to a temperature too low to ignite it. Upon this theory, its presence in test No. 4 and its absence in the other three, are difficult to explain.

In contradiction of the old theory, however, Herr R. Ernst, has recently shown that the amount of this gas (C O) formed in the combustion of carbon depends on the temperature of the fire; that, as the temperature of the fire





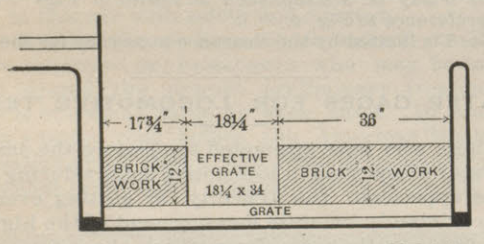


FIG. 4.—GRATES IN TESTS 2, 3 AND 4.

is above 1,800 deg. F, the first process of combustion is the entire conversion of the carbon into this gas. He has also shown that the gas will not burn even in the presence of air, so long as the temperature is above 1,800 deg. F.; it must be cooled before it will burn. Herr Ernst argues that, for high rate of combustion, there should be a rapid transfer for the heat liberated from the combustion chamber, in order that the carbon-monoxide formed may be sufficiently reduced in temperature to burn. This theory points to the possibility of heavy losses through the formation and non combustion of carbon-monoxide in the locomotive fire-box, in which very high rates of combustion are maintained, but the results of the Purdue experiments are reassuring. It must be admitted, however, that the relation of grate surface to smokebox volume, during all but the first test, gave conditions which more nearly satisfy those prescribed by Herr Ernst than would exist had the same rates of combustion been maintained on a full grate. On the other hand, it may be urged that the rate of combustion maintained in test No. 4 was higher than any which can be found in practice, a condition which would tend to neutralize the advantage of a large fire-box But, theory aside, the facts remain that the tests show very small losses by imperfect combustion, even when the rate of combustion is highest.

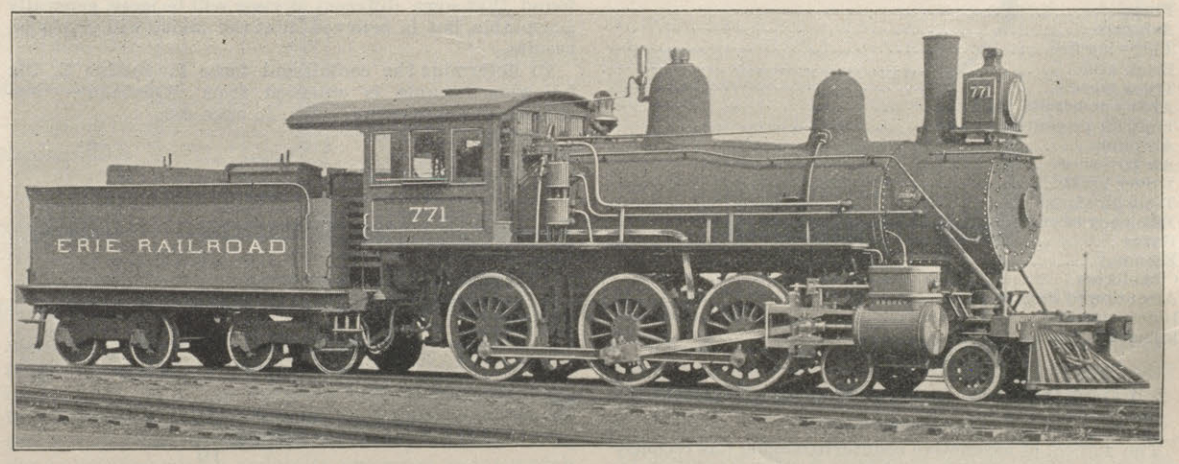
CONCLUSIONS.—The results show that the most efficient furnace action accompanies the lowest rates of combustion; and while the precise relationships established by the experiments may not hold for fuel which is different from that employed, nevertheless they enforce the general conclusion that very high rates of combustion are not desirable, and, consequently, that the grate of a locomotive should be made so large that exceptionally high rates will not be necessary. They emphasize, also, the importance of spark losses, which, during the experiments under discussion, practically equaled in value all other losses occurring at the grate.

Leaving the conditions peculiar to the experiments and assuming that the results obtained from them may be applied to the locomotive "Schenectady," when working under normal conditions, we find that the losses in evaporative efficiency which occur when the rate of combustion is increased above 50 pounds, may be accounted for approximately as follows: The relation between the rate of combustion and the water evaporated per pound of coal, under normal conditions, is represented by the line *a b*, Fig. 2. If it could be assumed that the heat developed in the furnace would be absorbed with the same degree of completeness for all rates of combustion, the evaporation would rise to the line *a c*; if, in addition to this, it could also be assumed that there are no spark losses, the evaporation would rise to the line *a d*; finally, if, in addition to these, it could be assumed that there were no losses by the excessive admission of air, or by incomplete combustion, then the evaporation would remain constant for all rates of combustion, and would be represented by the line *a e*.

That is, with the boiler under normal conditions, the area *a b c* represents the loss occasioned by deficient heating surface, the area *a c d* that occasioned by spark losses, and the area *a d e* that occasioned by excessive amounts of air and by imperfect combustion.

TEN-WHEEL PASSENGER LOCOMOTIVE—ERIE RAILROAD.

The accompanying illustration was prepared from a photograph of a 10-wheel passenger locomotive which was one of five recently built for the Erie Railroad by the Brooks Locomotive Works of Dunkirk, N. Y. The design is for bituminous coal and for a boiler pressure of 180 lbs. The Brooks people received an order for five of these locomotives and similar orders were placed with three other builders, making twenty locomotives in all of the same type. They were required to be built in an unusually short time. The first was to be delivered at the end of the forty-



TEN-WHEEL PASSENGER LODOMOTIVE—BROOKS LOCOMOTIVE WORKS

fifth day after the order was received and the remainder were to be finished within ten days after that date. At the time the orders were placed no drawings were made and no material was on hand. The Brooks works turned out the first of the five locomotives on time and the others were delivered on the four succeeding days, which was remarkably rapid work.

The following are the chief dimensions of these engines:

Cylinders	20x26 in
Driving wheels, diam.	62 in
Diameter of boiler	64 in
Fire-box, length	107⅛ in
Fire-box, width	40½ in
Flues, number of	282
Flues, diameter	2 in
Flues, length	13 ft. 2 in
Wheel base	rigid, 13 ft. 6 in
Wheel base, driving	13 ft. 6 in
Total wheel base of engine	24 ft. 2 in
Total wheel base of engine and tender	50 ft. 6 in
Weight in working order, total	144,750 lbs
Weight on drivers	108,000 lbs
Weight on front truck	36,750 lbs
Weight of tender	85,000 lbs

THE TRAVELING ENGINEERS' ASSOCIATION.

The report of the committee on sight feed lubricators before the Traveling Engineers' Association at the fourth annual convention, held at Minneapolis, Minn., September 8, treated of the location of lubricators, the proper methods of connecting them to the steam supply, the care of the apparatus, and the proper regulation to give the best oil mileage. The subject of tonnage rating of locomotives was presented in the form of questions which were submitted to the members, and the replies thereto. The committee believed tonnage rating to be the proper method of basing the loads given to locomotives, and saw the necessity of establishing a satisfactory plan for determining the hauling capacities of locomotives on different grades, and also for equalizing between empty and loaded cars. The possibility of increasing the output of the service under tonnage rating by the efforts of traveling engineers was apparent to the committee.

DISCIPLINE OF ENGINEMEN.

The committee reporting upon the question "Is not the discipline of engineers by fines or suspension detrimental to the service?" presented a report of which the following is an abstract:

This subject has of late excited a vast deal of interest in the railway world, and some of the ablest managers have given this matter great attention, and what they have said and written is no doubt familiar to most of us. It indicates an era of better times, as the discussion on arbitration between nations heralds the time when there will be no more war; and it is indeed a hopeful sign that there is fast coming a time when between railroad corporations and their employes the most friendly feelings will exist—a knowledge on the part of the employe that his complaint will receive consideration and his faults mercy; to the officer that the employe is as vitally interested in the successful operation of the road, in its success as a financial undertaking, as he is himself, or the president, directors or stockholders of the road.

Of the replies received, only from one road is there expressed the uncompromising belief that the only proper discipline for infraction of rules, or the punishment for accidents, is suspension. This member gives it as his unhesitating belief that the clemency, or the kind of discipline known as the Brown system, is not what is needed. The replies received from other members are all in favor of this system, or a modification thereof. It may here be in order to speak of what is known as the Brown system. It was inaugurated by General Superintendent George H. Brown, of the Full Brook Railroad Company, and in a general way it does away with suspension for violation of rules, or for such accidents as so frequently occur in railway service, and would be known in law as "suspending a sentence." In the main this system is one of information to every employe engaged in train service.

I will not go farther into details, but I would advise all members who are not familiar with this system, to procure one of the pamphlets from Locomotive Engineering, and give it careful and thoughtful attention. It is the opinion of those who have communicated with your committee in regard to this subject, that suspension or discharge for insubordination is the only proper course. Those of our members who are familiar with the Brown system also favor the credit and debtor system, that is, say 60 marks against his record means discharge. If an engine man has rendered himself liable to receive marks against his record he should also be given credit marks for good, or meritorious services performed, also credit marks where a given period of time, say one year, has elapsed without any debit marks appearing on his record. He thus has a direct incentive to wipe out the past, should there be any debit marks on his record.

In no way can the interest in the employes in the company's affairs be more greatly promoted than by their belief in the permanency of their employment and that with good behavior and interest displayed they are safe to make their homes and calculate for the future, as a man engaged in any other occupation.

It has often been charged that the enginemen have no interest in the company's affairs. This is not true, and if there are roads where it is true, it is the fault of the management and not of the employes. My own experience is that the men do as a rule take a keen interest in this, not only from the point that a road doing a good business, their own wages are thereby enhanced, but they keenly observe whether passenger trains are well filled and whether freight trains are hauling a good tonnage of freight over the road. My experience is that the record system will have a far more beneficial effect than can ever be had from suspension. A good man feels it more keenly than he would if he were suspended. It is the general feeling that where a man has been suspended for any offense, that in the suspension he has atoned for the fault and the record is clear, but where a record is kept he has a feeling that this is standing open against him, and he is only too anxious to have it erased, or perform some service that will atone for it.

It is my opinion that the Brown system can as well be applied to a large road as to a small road, and I will say in conclusion, speed the day when it is generally adopted.

REPORT BLANKS.

Your committee "On a form of card report on condition of engine and character of service rendered by engineers," has to say that it has been a long recognized fact that the traveling engineer was in need of a simple and easy way of keeping a close record of his men and their engines as he finds them in his travels on his division or road. The matter was discussed at considerable length at the annual meeting in 1894, and resulted in a commitete being appointed. The committee presented a very able report, together with a blank form to be used for the purpose, but it was the opinion of the members, after discussing the subject, that the blank submitted by the committee was not complete enough to contain the information desired to be kept on record, and it was moved that another committee be appointed to design a form that would cover all requirements.

After going over the ground very carefully and securing all the information possible on the subject your committee would respectfully call your attention to the form next attached, which in its opinion comes as near being right as can be for general use. On account of the service varying in different localities it would be impossible to get up a blank that would fit all purposes, but it is thought that with the exception of some slight changes to suit some special record desired, the attached blank will be of great assistance to the traveling engineer and a valuable record for a head of a locomotive department.

The blank form submitted is as follows:

X. Y. Z. RAILROAD COMPANY.

..... 189..

Condition of engine No.....
Engineer.....
Freman.....
Tire.....
Driving boxes.....
Wedges.....
Rod brasses.....
Eccentrics.....
Packing.....
Valves.....
Fire-box.....
Flues.....
Ash pans.....
Throwing fire.....
Brick arch.....
Truck wheels.....
Ability to handle train.....
Train air pressure.....
Air pump.....
Air governor.....
Driver brake.....
Train air signal.....
Efficiency of engineer in handling or use of air brakes.....
Firing.....
Economy.....
Cleanliness.....
Attention to signals.....
Improvement.....
Remarks.....

LOCOMOTIVE COUNTERBALANCING.*

The subject of locomotive counterbalancing has recently been quite a favorite one, and there have been many valable papers on this theme, but most, if not all of them, have been deficient in one particular; in that they have not clearly and simply indicated how to proceed with each part of the problem. For instance, one paper gave very carefully worked out formulæ for determining the effect of reciprocating weights, and how to correctly balance them, but the proportion of reciprocating weights to balance was passed by with a mere reference, as though of small consequence, when in reality it should be the fundamental question. In the following it is not the writer's intention to advance new theorems, but to select such points from previous papers (including those by Messrs. Parke and Sanderson, before the New York and the Southern & Southwestern Railroad Clubs respectively) as, with a few logical suggestions will place the subject in the hands of every master mechanic.

In developing these rules, three cardinal points have been borne in mind:

(1) The amount of reciprocating weight that can be left unbalanced may be a definite function of the total weight of the engine.

(2) The total pressure of wheel upon the rail m st not exceed a certain definite amount, depending upon the construction of bridges, weight of rail, etc.

(3) The vertical influence of excess balance must never be sufficient to lift the wheel from the rail.

The first proposition is based on the assumption that the greater the mass the greater may be the disturbing force without seriously affecting it, on account of its greater inertia. The second is evidently a rational deduction, not needing any demonstration. The third is necessary in order to avoid the wheels jumping off the rail, thereby causing a real "hammer blow."

Starting with the above assumption, we arrive at the following conclusions:

A. Each wheel should be balanced for all revolving weights attached to it.

B. The connecting rod is to be considered as part revolving and part reciprocating weight; the proportion of weight of rod which is to be considered as revolving weight varies with the length of the rod as given below:

Length of rod in feet,	5	6	7 & 8	9 & 10	11 & 12
Proportion as revolving weight.	.57	.55	.53	.52	.51

C. The part of weight of connecting rod considered as revolving weight, should be entirely balanced in the main wheel.

D. The amount of reciprocating weight that can remain unbalanced without seriously affecting the locomotive may be found by the formula:

$$Wr = \frac{Wt}{360}$$

Wr= unbalanced reciprocating weight on one side (including portion of main rod).

Wt= weight of locomotive in working order.

E. The remainder of the reciprocating weights should be counterbalanced by dividing the amount equally between the driving wheels on the side, provided that the sum of the static weight on any one wheel, plus the centrifugal force of this overbalance, does not exceed the maximum pressure allowed for the particular type of engine in question at the maximum speed at which it will run. If some wheel loads are heavier than others, the lighter wheels may take part of the overbalance which the heavier wheels cannot without exceeding the specified limit; nor must the centrifugal force exceed 75 per cent. of the static load on wheel.

F. The center of gravity of counterbalance must be opposite the crank.

G. The counterbalance should be brought out from the face of the wheel as far as clearance for the rods and proper design will permit.

H. The center of gravity of counterbalance should be placed as near the rim as possible, and the weight of the counterbalance reduced by this method.

I. Make reciprocating parts as light as possible.

Section A is self evident. B is taken from one of the papers above referred to. C comes under the same ruling as section A. In D the value $Wr = \frac{Wt}{360}$ is taken as representing good practice of the present day. It may be found that some different divisor will be more generally acceptable, but is believed that the above will give good results.

To determine the centrifugal force for section E, the following formula is obtained from Weisbach's "Mechanics of Engineering," Vol. I., page 609.

$$P = .00034\, u^2\, Gr.$$

where

P = Centrifugal force.
u = Revolutions per minute.
G = Weight in pounds.
r = Radius in feet.

Now letting

S = Speed in miles per hour.
D = Diameter of wheel in inches.

we have

$$u = \frac{S \times 5280 \times 12}{3.1416 \times D \times 60} = \frac{S \times 1056}{3.1416 \times D} = 363\ \frac{S}{D}$$

and

$$u^2 = 112896 \frac{S^2}{D^2}$$

and substituting,

$$P = 38.4 \frac{S^2}{D^2} Gr.$$

As in most locomotives r = I, then we may put simply,

$$P = 38.4 \frac{S^2}{D^2} G.$$

If now we assume that the maximum speed in miles per hour of the locomotive equals the diameter of driving wheel in inches, then,

$$\frac{S^2}{D^2} = 1 \text{ and } P = 38.4\ G, \text{ or say}$$

$$P = 40\ G.$$

It is also necessary to observe the limits of rail pressure. This will be different on various railroads, but on the Norfolk & Western it was taken as follows.

American type of locomotives - - 28,000 lbs. per wheel
Ten wheel type of locomotives - - - 26,000 lbs. per wheel
Consolidation type of locomotives - 25,000 lbs. per wheel

(These loads are per wheel and not per axle or pair of wheels.)

Referring to section F, it is found that the displacement of the counterbalance necessary to correct the effect of the weights and balance not being in the same vertical plane is so small on outside cylinder engines that it is accurate enough to place the balance directly opposite the crank. By bringing the counterbalance out as suggested in G it is possible to still more lessen the irregularity explained just above.

Section H and I need no explanation.

Having taken up these various points, the method of counterbalancing locomotives can now be reduced to the following.

RULE.

Divide the total weight of the engine by 360, this to be subtracted from reciprocating weights (including proportion of main rod) of one side of engine, and the remainder to be distributed among the driving wheels on one side. The sum of 40 times the amount of reciprocating weight allotted to any one wheel and the static load on the wheel, must not exceed the specified allowance for rail pressure, nor must 40 times the amount of reciprocating weight balanced exceed 75 per cent of the static weight. The weights to be put in each wheel will be inversely as the distance of center of gravity of counterbalance from center of wheel is to the crank radius, and must cover all revolving weights as well as the proper proportion of of reciprocating weight.

In order to obtain the best results both for the engine and track, the following points should be remembered:

1. Keep the spread of cylinders as small as possible.
2. Make pistons of malleable, wrought iron, or steel, to reduce weight.
3. Make piston rods of steel, and hollow.
4. Make cross-heads of cast steel, of light ribbed construction.
5. Make the rods of steel and of an I-section.
6. Keep counterbalances near the rim of wheel.
7. Keep counterbalance as far out as possible.

No. 1 can only be done when designing the engine.

No. 2 can be accomplished in various ways; however,

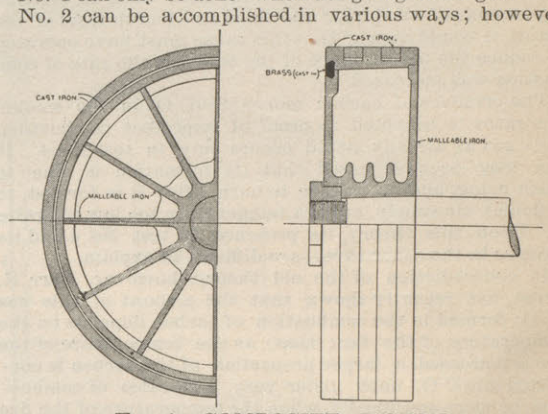
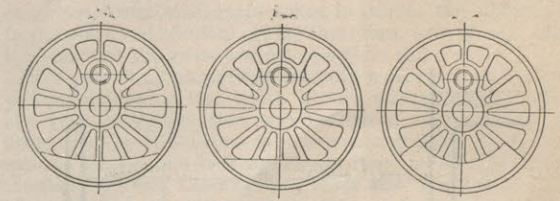


FIG. 1.—COMPOSITE PISTON.

the single plate pistons have the objections that they freely transmit the heat of steam side to exhaust side of the piston, but double plate pistons are not readily examined, as they should be, especially when very thin. Besides a cast iron wearing surface is desirable, while bolts and rivets are equally undesirable. A design of piston that promises very favorable results, and will meet all the above objections, is shown in Fig. 1. The center is malleable iron, and the wearing ring cast iron, the latter fitting against a shoulder at one side, while a brass retaining ring is cast in and opened out on the other side,



FIGS. 2, 3 AND 4.—COUNTERBALANCE WEIGHTS.

making practically a single piece. It also takes ordinary cylinder heads.

For No. 3 the use of nickel steel has been suggested.

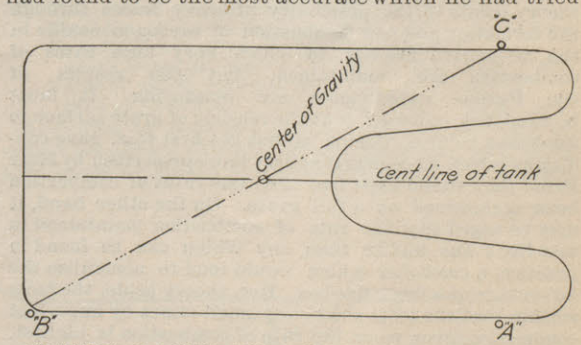
No. 4 depends entirely on the arrangement of guides, etc.

No. 6 may be accomplished as shown in Figs 2 and 3 in preference to Fig. 4.

No. 7 is limited by the clearance necessary for the rods, etc.

WATER GAGES FOR LOCOMOTIVE TESTS.

Those who have attempted to measure the amount of water evaporated in locomotive boilers during road tests appreciate the difficulty in getting even an approximately accurate measurement of the hight of the water in the tank, from which the consumption may be figured. It is useless to attempt to get the hight from a float placed in the manhole, or for that matter, from any single measurment, because of the likelihood of the tank having stopped upon a piece of track which is not level. In a recent conversation with Mr. H. H. Vaughan, mechanical engineer of the Great Northern Railway, this subject was mentioned and he spoke of a simple plan which he had found to be the most accurate which he had tried



WATER GAGES FOR LOCOMOTIVE TESTS.

for this purpose, and the idea is so easily applied that it seems to be a matter in which many will be interested.

Mr. Vaughan had used gage glasses at three corners of tanks and from them worked out the mean hight. It then occurred to him that the average hight was the hight of the center of gravity of the free surface of the water, since the center of gravity

*From a paper read before the Association of Engineers of Virginia by Mr. G. R. Henderson, mechanical engineer Norfolk & Western Railway. Reprinted from the Journal of the Association of Engineering Societies.

is a point such that on either side of a line drawn through it the product of each small area of the surface and its distance from that line is balanced by a similar small area multiplied by its distance from the line and upon the opposite side thereof. The method of ascertaining the mean hight of the water is to locate two gage glasses in such positions as to bring them on opposite ends of the line passing through center of gravity of the tank in such manner as is indicated in the accompanying sketch. The mean of the readings of these two glasses gives the measurement sought or the true average hight of the free surface All the planes lying in this line will enclose approximately the same volume between the bottom of the tank and the sides. The reading of the third glass as at A in the sketch does not need to be considered as the measurements of those at B and C are sufficient. This precaution for obtaining the hight of the water is not an unnecessary refinement because the water level will vary as much as 4 inches, which sometimes will make an error of 25 per cent.

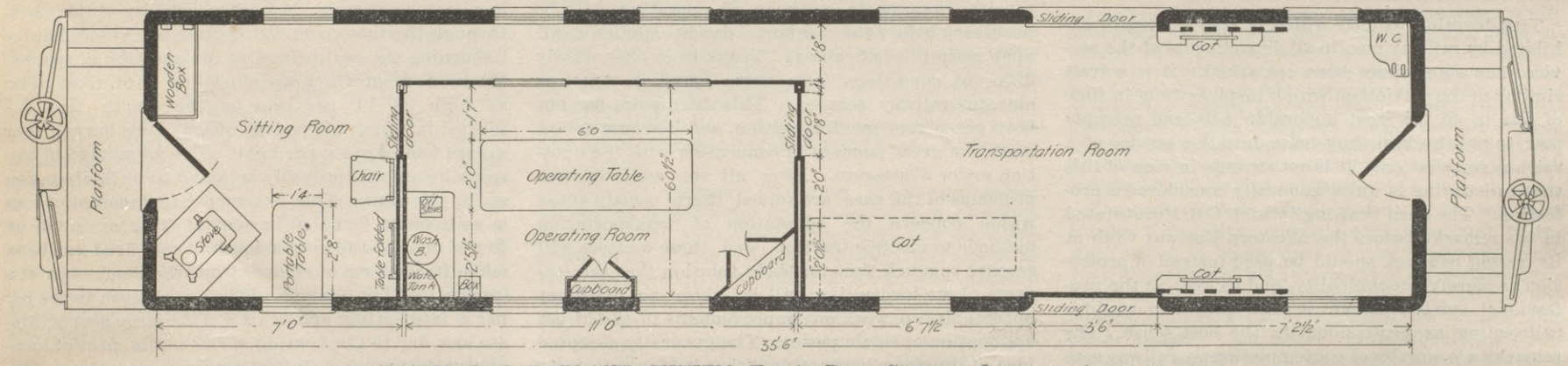
A HOSPITAL CAR.

Through the courtesy of Frank H. Caldwell, M. D., chief surgeon of the Plant system, the accompanying illustrations are presented of the hospital car which has been recently put into service upon the Savannah, Florida & Western Railway. This car is 35 ft. 6 in. long over the body and is equipped with all of the conveniences of the hospital as is indicated in the illustrations. Dr. Caldwell writes that since the car has been in use it has given eminent satisfaction, and that those employes who have been so unfortunate as to have to occupy it have expressed themselves as being highly pleased with its comforts and with the facility with which their cases have been handled. Employes are carried several hundred miles in this car with safety and comfort.

The object of the car is mainly to make it possible to give employes or passengers who may be accidently injured the prompt preliminary treatment which is of special value in such cases. Dr. Caldwell in a paper read before the American Medical Association states that it has been conclusively demonstrated that injured persons except when suffering from very severe injuries to the head, spine, the thoracic and abdominal cavities or who are in a state of profound shock may, when properly handled, be transported almost an indefinite distance without endangering life or increasing the state of injury. The system for safe transportation of injured persons which has been developed by Dr. Caldwell is complete and provides for the transportation of patients suffering from lighter forms of injury upon stretchers in regular passenger trains and in order that the comfort of such sufferers may be properly attended to, the surgeons along the line visit the patients at the stations at which the trains stop, the line surgeons being notified whenever their services are required in this way. The distance between these surgeons is from 20 to 40 miles.

Ambulance cars have been proposed from time to time but on account of unnecessary elaborateness their expense has stood in the way of their employment. Dr. Caldwell says: "What we need is a strong stiff car with first class trucks furnished in simplest style without upholstery of any kind. We need a transportation room, an operating room and a small consulting room." Car "H", which is the one illustrated, is fitted up in accordance with this idea. It is carried upon two four-wheeled trucks and was remodeled from an express car. The refitting brings the total value of the car complete, as shown in these illustrations, to about $3,000. In the plan view it will be seen that one-half of the car is available for transportation, a permanent cot being shown by dotted lines and in addition to this are two cots which are folded against the door guards when not in use. One of these may be seen at the left in Fig. 3, which also shows other cots in the transportation room. The transportation room is furnished with wrought iron beds with woven wire springs. The legs of these are tipped with rubber to prevent slipping and give elasticity. An air bed is also provided, which is folded into a very small compass when not in use and packed in a closet. A hammock arrangement is provided which hangs from the roof from spiral springs.

The operating room is supplied with an iron, glass top table, and all necessary appliances for the treatment of shock and for the performance of perfectly aseptic operations. Supplies of sterilized water are carried and all of the supplies necessary to the performance of such operations as would be required, and also for the dressing of ordinary wounds. The car is painted with a specially prepared paint which may be scalded without injury and which will stand disinfection by means of superheated steam or air. Dr. Caldwell recommends that a relief car should be provided for every 200 miles of road, to be located in the center and having a run of 100 miles in either direction. There are few cases which cannot be transported in a car of this kind, and for such as cannot be moved this equipment offers comfortable quarters wherein any necessary operation may be performed.



HOSPITAL CAR—PLANT SYSTEM—FIG. 1.—PLAN SHOWING INTERNAL ARRANGEMENT.

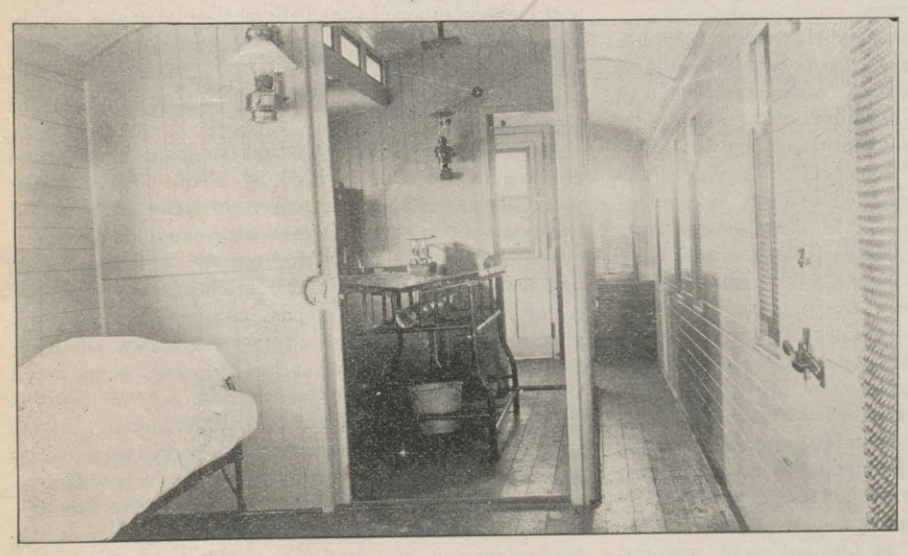


FIG. 2.—INTERIOR SHOWING OPERATING ROOM.

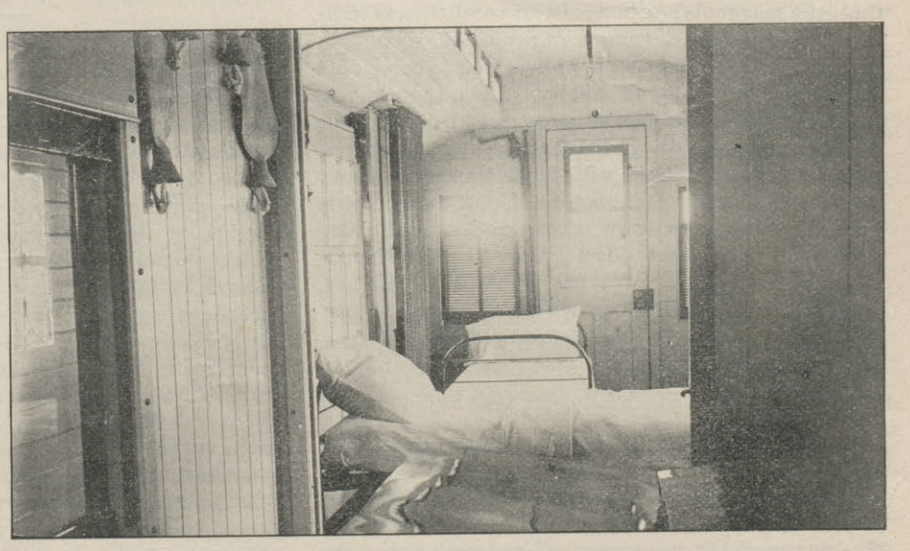


FIG. 3.—OPERATING AND TRANSPORTATION ROOMS.

The Denver Railway Club.

The Denver Railway Club is just in process of organization. It is intended to include those connected with the mechanical department of railways in the mountain region. It will follow the lines of the Western and other railway clubs. The managers and superintendents have already a successful association of their own in that city.

Air Brakes in a Nutshell

The Chicago Tribune notices the rapid introduction of air brakes upon railway cars and, under the caption "Passing of the Brakemen", states that the application of this apparatus is being carried on so rapidly that in a short time the brakeman will disappear. In discussing this matter the following description of air brakes was given which undoubtedly will be "within the comprehension of the most inexpert":

"By the automatic process trains can be stopped so quickly on levels or grades, curves or bridges, that "full head" collisions are rare and collisions with all forms of obstructions less probable. The engineer now does in an instant what it took the brakeman many minutes to perform, and does it much more effectively. An explanation of the operation, recently published, brings it within the comprehension of the most inexpert:

'Under each of the cars is a rubber pipe connected with an air compressor on the engine. This pipe leads to and supplies an air reservoir under each car. These reservoirs are loaded from the engine with compressed air to the amount of 70 lbs. each. The pressure of this air keeps open the brakes, and as long as the compressed air remains in the reservoirs under the cars the brakes are open. By turning the lever on the engine, the compressed air is released and as it is released, the brakes on each of the cars close automatically, pressing against the wheels and practically locking them. As soon as the train is brought to a full stop, of which the panting of the compressed air as it escapes from under the cars gives notice, the reservoirs are again filled by a turn of the lever on the engine, and this fills the reservoirs under the cars, and thereby automatically releases all the brakes at once.

Commerce, like a stream of water, flows in the direction of the least resistance.

The freight offices at Mount Clare, which have heretofore been in the old building on South Poppleton street, below Pratt, have been moved to more commodious quarters at the corner of Pratt and Poppleton streets. The old building was the first railroad depot built by the Baltimore & Ohio Railroad Company in 1844. It was in that building that the first telegraphic message was ever received.

The longest bridge in the world is the Lion bridge, near Saugong, China. It extends 5¼ miles over an arm of the Yellow sea, and it is supported by 300 huge stone arches. The roadway is 70 ft. above the water and is enclosed in an iron net-work.

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THE devotion to duty which is very generally exhibited by railway men in all departments of the service, has many times been remarked. It is a trait similar to the patriotism which inspires them in time of war to do the most honorable acts and prompts men to put the best they have into the service of a railway corporation. It is not strange in view of this that railroading is quite generally considered a profession. The term "calling" which Col. Prout stated in his remarks before the Western Railway Club at its recent banquet, should be used instead of profession is merely a technicality, and as long as the professional spirit is present it seems proper to consider railroading as professional in the best sense. His remarks are worthy of contemplation by railway men and particularly those which concern the part which subordinates may play in the solution of the railway problem.

THE extreme dullness in the iron trade is shown by such facts as these. Production of pig iron has fallen from a maximum output of two hundred seventeen thousand tons to one hundred fifty thousand tons per week. Meanwhile, stocks have reached about one million tons, the usual surplus being about one-half that amount. There has been no improvement and no sign of improvement. Notwithstanding that, the market is not in a critical condition, as indicated by the large volume of projected or contemplated work. That work is destined to come onto the market gradually or rapidly. Upon the removal of the current objections to investment it is probable it will come rapidly. In that event the same restriction of production will be felt and prices may turn a sharp curve. This is the point to be kept in hand by boards, railway managers and purchasing agents. The present down grade in prices is temporary. The very low level prices have reached, will in itself stimulate preparatory steps and prudential purchases. It will be well for buyers to exercise whatever foresight they possess during the next few months.

STEAM LOCOMOTIVES NOT YET SUPERSEDED.

ON another page of this issue an abstract appears of the report of a committee upon the subject of motive power which was presented last week before the American Society of Railroad Superintendents. The portion of the report with which it is most easy to agree is contained in the concluding paragraphs in which it is pointed out that the change from steam to electric traction will come in general application only after the new form has demonstrated its superiority to steam from an economical standpoint. In reading the report, it would perhaps be well to consider the last paragraphs first, or, in a sense, to read it backward, because of the fact that thus far practical figures are not available which show the relative economy of steam and electric traction. It is fair to question whether the steam locomotive has reached the highest point possible to be attained in the direction of economy. It is also a question whether enough is known concerning the working of the locomotive to warrant taking the ground that there is no direction even including the principal of compounding "which will be able to work much of a revolution in economical locomotive practice?"

It would be rash to predict that electric will not supersede steam traction, but to prophesy that the change will not be in the near future is another thing. Electricity is in its infancy, and while electric traction is certainly a lusty youngster, three things must be borne in mind by those who are preparing for this great change, the first of which is that both forms are dependent upon the same force, the expansive power of steam. The second is that the steam locomotive has only recently been studied from the standpoint of the stationary engine, for until the advent of the stationary locomotive testing plant comparisons could not be made of nor satisfactory data taken from locomotives, and it is believed that the result of investigations now being carried out will be to produce great improvements in steam locomotives. The third point is that the conditions under which electric traction will probably be successful are so widely different from those now found in railway operation that extensive changes in methods of operating will be necessary before the "infant" can be applied at all upon main lines of railway. Trunk lines offer widely different conditions from those found in street or elevated railway service. This third point has not been given very much attention, and it seems to be a matter of great moment in connection with the question under discussion. After all the motive power problems of the case are solved there remain those which concern the adaptation of transportation methods to electric traction, and these matters will require so much time for their solution that the students of the locomotive will be given an excellent opportunity to work out improvements in the direct application of steam power. The generally accepted idea of the steam locomotive is that it is an extremely wasteful combination, but records show that it is not more extravagant than other high speed engines of similar class and those who are following the experimental work which is being carried on in connection with the locomotive testing plants believe that there is reason to expect material improvements in its economical performance. Electric locomotives will in all probability, not entirely supersede direct steam traction, so that these efforts will not be lost.

RATES OF COMBUSTION ON LOCOMOTIVE GRATES.

The question of the proper sizes of grates for locomotives is very complex and requires the consideration of a great many details concerned in the combustion of fuel and the absorption of heat derived therefrom by the heating surfaces. The question of large *vs* small grates does not properly represent the problem, because grates cannot be designed without the consideration of the influences of the heating surfaces. Neither can the heating surfaces be determined upon independently of the grate area. This has been referred to repeatedly as one of the most important matters connected with locomotive designs, and the unfortunate lack of data of undisputed accuracy, or for that matter of any satisfactory figures upon the effect of different rates of combustion and of different relations to the heating surfaces, has been often remarked. There are sufficient figures which show that in general better evaporative efficiency is obtained by moderate rates of combustion. Prof. Goss of Purdue University has the distinction of presenting the first reliable data on this subject which has been produced upon a basis of actual practical conditions and from which a satisfactory examination of all conditions involved may be made. For some time he has been conducting tests upon the stationary locomotive testing plant at Purdue and has embodied some of the results of the most recent work in regard to rates of combustion in an admirable paper which was presented at the September meeting of the New York Railroad Club, and which appears nearly in full else where in this issue.

Prof. Goss concludes from this work that in order to give efficiency in the consumption of fuel, locomotive grates should be sufficiently large not to necessitate a high rate of combustion. He shows reasons for his conclusion and the paper is altogether the most satisfactory argument which has yet appeared in connection with this subject. The conclusion drawn is quite too general to be used in establishing the proper grate area for different types of locomotives, but it establishes the theory of moderate combustion on a practical foundation. Further tests, however, in the same direction will undoubtedly be the means of producing information from which good combinations of grate areas and heating surfaces may be selected. The plan of tests was so arranged as to eliminate all variables except those incident to different rates of combustion, hence the results are not complicated by introducing unknown quantities. The only factor which is introduced by the method employed, which perhaps was not desired, was that in the cases of the small active grate areas the fire-box acted as a combustion chamber which, however, would tend to increase the efficiency at the higher rates of combustion and would emphasize the difference in efficiency found.

The principal reasons for the falling off in efficiency at the higher rates of combustion seem to be that it is more difficult to burn the coal at the high rates and also that the excess of air in the smoke-box gases is greater. A higher velocity of the gases through the tubes contributes to this. The difficulty in burning the coal brings up the question of sparks, the losses from which are shown by Prof. Goss to be as high as 19 per cent in the fourth test described in which 241 pounds of coal were burned per square foot of grate per hour. The advantage of the spark losses will probably be found to be fairly taken at 10 per cent. This is a surprising amount of loss in spite of the fact that in special cases as much as 20 per cent of the total amount of coal fired has been taken in the form of cinders from the smoke-box of a locomotive. The analysis of the losses given in the paper is interesting, and in view of the large proportionate loss due to the heating surface, this part of locomotive designing certainly requires attention. The losses due to imperfect combustion are surprisingly small and not the least valuable feature of the paper is the development of this fact. This work is but the beginning of a systematic study of the conditions existing in locomotive fire-boxes and important information will probably be obtained by applying the same methods to different designs and types of locomotives. It does not seem too much to expect that by comparison of different proportions, a general idea of the proper relations between the grates and heating surfaces for different kinds of service and different coals may be obtained. It will will be remembered that this matter is in the hands of a committee of the Master Mechanics' Association and the conclusions reached by Prof. Goss will probably be of great value to that committee in its investigation.

As before stated the question of grate areas cannot be considered as decided by Prof. Goss. There yet remains for solution the conundrum offered by the fact that in certain cases increased efficiency of evaporation seems to result from the blocking off by perforated dead plates, of a portion of what might be termed a small grate as compared with the grates which extend over the frames of locomotives. A claim has recently has been made that the evaporative efficiency of a locomotive having a grate area of 26½ square feet and a heating surface of 1900 square feet has been improved by blocking off a portion of the grate, amounting to about one-quarter of its area and extending fore and aft through the center of the grate, a plate used for this purpose being perforated with holes for the admission of air. If this claim, which is about to undergo investigation, is substantiated, the force of the statement that combustion in locomotive fire-boxes is an intricate problem will be more than ever confirmed.

As Prof. Goss states in the paper, the results which he found may not be taken as applying to other coals differing from Brazil block. The extensive losses from spark throwing may be found to be

less with other fuels. There are many difficult questions which are not yet answered, such as the reason for the high degree of economy of the new locomotives on the Chicago & Northwestern Railway which are fitted with grates which cannot be called large, and upon which the rates of combustion are relatively high. Also it would be useful to know the effect of varying the depth of the fire-box, but it is fortunate that definite figures upon one set of conditions have been taken. The conclusions by Prof. Goss are based upon the careful work which is characteristic of all of his investigations and all who are interested in the subject may be congratulated that he has undertaken this line of research. This beginning increases the interest in knowing the effect which would be produced by an increase in the heating surfaces and while this is more difficult to ex periment upon, it is hoped that it may give up its secret in the near future. Can anyone tell whether the effect which Prof. Goss finds as following a restriction of the grate area will not be more than offset by an extension of the heating surface?

WESTERN RAILWAY CLUB.

The September meeting of the Western Railway Club was held in Chicago on the 15th instant at the Auditorium Hotel, with a good attendance. The first subject for discussion was the paper by Mr. D. L. Barnes entitled "Relation of Steam to Power and Efficiency of Electric Motors for Locomotives," which was introduced by Mr. C. H. Quereau. The discussion was taken up by Mr. Wm. Forsyth, Prof. Goss and Mr. George Gibbs, and was concerned especially with the relative ranges of speed for efficient operation of locomotives and electric motors. The next subject taken up was the paper presented at the May meeting by Prof. Goss entitled: "Some Notes on the Performance of the Purdue Locomotive, 'Schenectady.' " The discussion being opened by a brief printed paper by Mr. D. L. Barnes, comparing Prof. Goss' results with regard to speed and efficiency with those which may be obtained from electric locomotives. This discussion was participated in by Messrs. Herr, Gibbs, Quereau, Setchell and Forsyth.

It was announced by President Waitt that some difficulties had arisen under the new interchange rules of the Master Car Builders' Association, and the following members of the club were appointed as a committee to consider the questions and propose suggestions for solution at its next meeting. The next subject was "Difficulties with the Use of Metal Underframing for Tenders and Cars," and was opened by Mr. E. M. Herr. A number of members spoke with reference to the amount of protection needed for metal underframes and cars and the necessity for regular and frequent applications of paint to metallic surfaces was brought out. A paper entitled "The Apprentice Boy" was then read by Mr. J. N. Barr and will be presented in a future issue.

The fourth annual banquet was held in the evening after the close of the business meeting and the arrangements were very carefully carried out by a committee consisting of Messrs. H. C. Buhoup, chairman, A. J. Farley, and W. D. Crosman, the committee being ably assisted by Mr. A. J. Schevers.

President Waitt delivered the following address:

Again the rapid flight of time has brought us together at the beginning of another working year of our club to lay aside for a few moments our active duties and perpetual worries to enjoy in a festive way the good things provided for the inner man, and the better things in store for our mental improvement and social enjoyment.

A year ago to-night it became my pleasant but brain racking duty to act as toastmaster at our banquet, the then retiring president having,in a very pleasant but slick way, evaded the grasp of the entertainment committee and relieved himself of the duty which was supposed to be the lot of a retiring president of a railway club. This year our esteemed retiring president, Mr. Potter, has believed in following the precedent so recently established, and in spite of ardent protests I find myself on this occasion rather staggered under the dual burden of speaking for the incoming president and acting as toastmaster as well. However,every cloud has a silver (or golden) lining, and I feel somewhat relieved in knowing that next year I can follow the now doubly established precedent and keep quiet and let my dinner digest without mental disturbance.

It is with peculiar pleasure, however, that I can speak to-night in the theme "Our Club." Not that I have much to say, nor that I can say what little I have in mind in a particularly pleasing way, but it is gratifying for me to have this opportunity, in the presence of this company of my friends and co-workers, to express to you the sense of bligation I feel to you for honoring me by making me the presiding officer of the Western Railway Club.

We cannot as a club look back on long years of work, it being to-night but twelve years and five months old. We cannot boast the largest membership, for our newly born sister club at St. Louis has for the time being outnumbered us. But the Western Railway Club can with pride look back over its twelve years' work and point to some of the most valuable papers, from both a technical and practical standpoint, that have ever emanated from any similar organization. The Western Railway Club has been peculiarly fortunate in its membership. It is with great satisfaction that we are able to point to the fact that we have among our active members a large number of men fortified by a thorough technical training which has been supplemented by years of practical work, enabling them to bring to the deliberations of our club the sound reasoning and good judgment for which our work has for many years been noted. It is with just pride that we can look over our soon to be published index of papers presented since the club's inauguration and see among them such able productions as the two papers on "Electric Motors" presented by Mr. D. L. Barnes in April, 1894, and May, 1896; the paper on "Wide Fire-Box Locomotives," by Mr. J. Snowden Bell; the paper on "Railway Signaling," by Mr. Geo. Gibbs; that upon "Notes on English Railway Practice," by Mr. F. A. Delano, and on "Locomotive Fuel," by Mr. Wm. Forsyth, and besides these many others of equal merit with which you are all more or less familiar. Our proceedings have presented to the railway world also a large amount of valuable matter obtained by carefully conducted experiments and tests by many of our most valuable members.

As we look with pride on the past we should not stop satisfied. We commence on the thirteenth year of our history with our largest membership, 888.

We include able men from nearly all branches of railway service, and with such a constituency our possibilities are great. A well known public man has said: "Opportunity is the measure of responsibility"; surely our opportunities are great in this wonderful central metropolis of the nation. Let us during the coming year each one take a greater interest than before, in attendance and participation at our meetings, in extending our membership and in broadening the field of our club work. With the earnest intention to serve the club in every way for its best interests, I solicit from you its members and friends your hearty co-operation.

After his remarks President Waitt introduced himself as toastmaster and announced with regret that Mr. J. H. McConnell, superintendent of motive power of the Union Pacific Railway, was unable to be present and give an address which was expected from him on the subject of "Compressed Air in Railway Shops". Col. H. G. Prout of the Railroad Gazette, New York, was then introduced, and responding to "The Press", spoke in part as follows:

I have spoken of the railroad profession. Perhaps this is premature. Perhaps I should have said railroad business or occupation or calling. Perhaps railroading is not yet a profession. The Century dictionary defines a profession as "a vocation in which knowledge is used by its practical application to the affairs of others in serving their interests or welfare." Worcester has defined it as "an employment requiring a learned education." Obviously, railroading does not yet fill this definition. No one has yet organized a course of study by which one shall become possessed of the fundamentals of railroading as a learned education. There is an effort now on foot to establish such a course in one of the great universities, but the president and some of the faculty of that university, and many old railroad officers have doubts if this calling can be organized into a profession to be prepared for by systematic courses of study in college. It seems to them too big and complex. It seems to be too much affected by the ever changing conditions of human life to permit it to be taught as a science with fixed laws. The art of its administration, like the art of government, cannot be imparted by teachers, to pupils as can the principals of the law and the gathered wisdom of the pathologist.

Many other professions contribute to the administration of the railroad, but the engineer, the architect, the lawyer, the doctor, even when they give their lives to the service of the railroad still remain professional engineers, architects, lawyers and doctors. But this is not the whole story.

A profession is more than a calling for which one is prepared by learned education. When we say profession there at once arises in our minds the thought of an unwritten, unformulated body of tradition which governs conduct. There at once comes up a notion of a special standard by which we measure performance. We remember that we ask first and always of a professional man that he should do the work which he undertakes for someone else just as well as he possibly can, regardless of its effect on his own fortunes. We remember that a professional man may be highly successful and yet make no money for himself. When we think of a man who has attained real eminence in his profession, the last thing that we think of is his private fortune or his public office. A profession then, is a calling around which have grown up certain traditions of self sacrifice, for which mankind has set up certain very exacting standards which demand in its followers above all other things, devotion to duty. Thus we get at a simple expression of the bottom principle of the profession which distinguishes it from other callings or occupations. The professional man assumes an obligation towards his client; until he gives up that obligation his duty to his client takes rank before his duty to himself. All this we may sum up in the term "professional spirit."

Now, I come to the bearing on you and me of this attempt to state what we mean by a profession. I like to think that the professional spirit is growing fast among railroad officers. Whether or not railroading is a profession; whether or not it ever can be a profession is a small matter, and the vital thing is that railroad officers should have the professional spirit. We must look to this spirit to save the railroads from the ignorant and corrupt subordinate. We must look to it to save the railroads from the brigands in high places seeking only to make their own fortunes. Perhaps we must look to it to save the railroads from confiscation by socialists and populists, and in fact, by honest voters who would come to be classed with either. How the professional spirit will do all this I need not point out. It will administer the properties for the interest of their owners and not for the profit of salaried officers. But, in the long run the interest of the owners is the interest of the public, and thus we find the probable solution of much that is most troublesome in what is called the railroad problem.

It seems to me that in the last ten or a dozen years there has been a great growth of this spirit in railroad officers. Perhaps it is because I have come to know more of the best class of them, and to better know their motives; but surely there are scattered all over this nation a great many men who are serving the railroads not only with zeal and ability that cannot be equaled in any other calling, but with splendid devotion. I name no names, you all know these men, you live with them, you work with them, —some of you are such men. One of these men, who had been my personal friend, died the other day—sacrificed to this devotion. He was general manager of a road earning ten millions a year. His days and his nights were given up to his duty, and he died of overwork, not yet an old man; and he left to his family a fortune of barely $15,000. But he was happy to know that he had done the work that he undertook for others like an able and honest man, and he left a memory which was better than money.

I am proud to think that an honest and courageous railroad press has had some small part in bringing about the change which I think I see. I am glad to believe that a servile press can do little to delay that movement. A German philosopher once said that every nation has the kind of Jews that it is fit for; and this is partly true of the newspaper. Within limits you can get the sort of paper that you are fit for. You can help the editor tremendously by telling him what you think of him, and if he is not a jackass, he will be glad to hear it.

The next speaker was President J. H. Smart of Purdue University, who paid a high tribute to the work which is being done by the club, and spoke very pleasantly of his enjoyment in attending a number of its meetings. He believed that college professors would be greatly benefitted by coming into closer contact with active professional work and thought that they would be much better prepared to instruct students if they would partake in the discussions of such organizations. He commended the "men who save things," the saving and economical use of material and supplies being a most important part of the work of railway men. In conclusion he spoke in a feeling manner with regard to the devotion of railway men to their calling and endorsed what Colonel Prout had said upon this subject. President Smart was one of the most entertaining speakers of the evening and showed that the interest taken in Purdue University by the railway men was reciprocated by the faculty of that institution.

Among the other speakers Mr. J. H. P. Hughart, second vice president and general manager of the Grand Rapids & Indiana Railroad responded for the transportation department, Mr. M. C. Markham, assistant traffic manager of the Illinois Central responded for the traffic department, Mr. F. W. Morse, superintendent of motive power of the Grand Trunk Railway, for the mechanical department, and Mr. H. C. Buhoup gave some interesting reminiscences of the formation and the troubles experienced during the early days of the life of the club. At this point a very taking song, written to a popular tune, by Mr. W. D. Crosman, secretary of the club, was rendered by the Sohmer quartet, after which Mr Mr. George H. Heafford represented the passenger department in a few enjoyable and characteristic remarks. The last number on the programme was an apostrophe to "Water," which was rendered by Mr. E. B. Leigh, of the Chicago Railway Equipment Co. This was a beautiful poem which was thoroughly enjoyed, and it is to be regretted that Mr. Leigh was under obligations to the author not to allow it to be published.

Considerable fun was caused by a straw vote for the presidential candidate which resulted in 89 for McKinley, 4 for Palmer, there being no votes whatever for Bryan.

The decorations of the banquet hall were especially fine in which patriotism was made prominent by the display of the national flag. The number partaking of the banquet was ninety-eight, and all showed thorough appreciation of the excellent preparations of the committee. One of the interesting features of the occasion was the menu, which was in the form of a time card, and the arrangements

were so perfect that the schedule was carried out to a minute. The following is a copy of the card:

CONDENSED

TIME SCHEDULE

WESTERN RAILWAY CLUB "SPECIAL"

TUESDAY, SEPTEMBER 15, 1896

"ALL ABOARD!" AT 6.30 P. M.

EATING STATIONS.	Sun Down Express.
1. THE LETTER R IS HERE.	ARRIVE 6.31 P.M. DEPART 6.40 "
2. WAVING CORN, and Garden Truck,	ARRIVE 6.45 " DEPART 6.57 "
3. AS GOOD ON TUESDAY AS ON FRIDAY, with Irish Accompaniment.	ARRIVE 7.03 " DEPART ★7.14 "
4. YOUNG FILLY, with Hot Tomales,	ARRIVE 7.20 " DEPART ★7.30 "
5. PUNCH, Punch with care,	STOP ON SIGNAL.
6. QUAIL NOT: SNIPE IT,	ARRIVE 7.35 P.M. DEPART ★7 50 "
7. COLD WEATHER ANTICIPATED,	ARRIVE 8.00 " DEPART 8.15 "
8. SKIP IT, IF YOU DON'T LIKE IT,	ARRIVE 8.20 " DEPART QUICKLY.
9. NOT FROM CHINA,	ARRIVE 8.27 P M.
10. COMPLIMENTS OF GENERAL WEYLER,	ARRIVE ★8.28 "

★ Take Water.

NOTE.—This train has exclusive right to the road.
The Conductor will allow speakers five minutes for possible variation in watches.

The members freely expressed their enjoyment of the occasion which was the most successful which has yet been held. Music was furnished by Prof. Hand's orchestra and the Sohmer quartet.

TRANSLUCENT FABRIC SKYLIGHTS.

The Translucent Fabric Company of Quincy, Mass., has brought out a material to take the place of glass in skylights and after continuous service of over seven years, it is pronounced to be as good as when first put in place. One of the chief advantages to be obtained by its employment in train sheds, freight houses and similar buildings having skylights of large area, is due to the light weight of the material which permits of a simple inexpensive and light form of skylight construction. The joints are made watertight by a special form of construction in use for over seven years have never leaked during that time nor have they cost anything for repairs. The accompanying illustration shows the application of this material to a skylight in the shops of the General Electric Company at Schenectady, New York. The fabric is strong, and in panels 18 x 36 inches in size, has carried a weight of over 400 lbs. per square foot without fracturing.

The attachment of this fabric is different from glass. The material is stretched upon a wood frame instead of being set in putty. A skylight of this material on the new forge shops of the Berlin Iron Bridge Company at East Berlin, Conn., is 300 ft. long by 18 ft. in width and in addition to this about 6,000 sq. ft. of other skylights are composed of it in the same plant. The skylight of the General Electric Company shown in the accompanying illustration is double and has an area on each side of about 350 ft., by 16 ft. this company having used over 17,000 sq. ft. of the fabric during the past year. The material is so strong that it is reported to be able to sustain the weight of a man walking upon it without injuring it. A catalog recently issued by the manufacturers states that the amount of light transmitted is equal to that which will pass through ribbed glass ‡ in. in thickness and that the material will not burn unless set fire at the edges and then it burns very slowly; also, brands or coals dropping upon it will not set fire to it. As to cost it is stated that it can be put in, all things considered, for from 10 to 30 per cent less than the cost of the ordinary glass skylights, the cheapness being partly on account of the simplicity of construction of the skylight, and framework which may be employed and it is also due to the lightness of the material itself. The manufacturers are the Translucent Fabric Company, Quincy, Mass. The Boston office is at 64 Federal street.

TRANSLUCENT FABRIC SKYLIGHT—SHOPS OF GENERAL ELECTRIC CO. SCHENECTADY, N. Y.

employed with this material. The fabric is said to have a marked advantage over glass in being practically unbreakable, and for this reason leaks on account of breakage or cracking are not experienced; neither is there danger of injury of persons passing or working under it which exists to a large extent when skylights of thick glass are used.

The manufacturers believe that it possesses all the advantages of wire glass and state that it will not crack under any conditions. The translucent fabric consists of the transparent material spread over steel wire cloth with 12 meshes per inch which gives the panels a flexible and elastic property, permiting of adjustment of any shape which the roof structure may take owing to the expansion and contraction of the framework. The manufacturers state that the skylights mentioned as having been

FOURTEENTH ANNUAL CONVENTION OF THE ROADMASTERS' ASSOCIATION OF AMERICA.

The report of the committee on "Tie Plates," presented at the Fourteenth Annual Convention of the Roadmasters' Association of America at Niagara Falls, September 8th, was presented in the RAILWAY REVIEW of last week, and abstracts of the other reports are given below:

ELEVATION OF CURVES.

The committee on "Elevation of Curves" is of the opinion that curves should be elevated for the highest speed at which passenger trains usually run over them, limited, however, to an elevation of about 7 in., if the track also carries freight traffic. If exclusively passenger traffic we would not be limited to 7 in., if the circumstances seemed to require more.

We recognize the various conditions that may require a modification of this rule. In such cases each will be governed by the prevailing circumstances, bearing in mind that the passenger traffic deserves more consideration than freight.

At the proper speed for which the curve is elevated each rail carries equal weight, in other words, a weighted line through the center of gravity of the car will remain perpendicular to the plane of the rails while passing the curve.

When trains pass curves at speed greater than the track is elevated for, the weight on the outer rail is increased, flange friction is increased, and the tendency to turn the outer rail over is much greater, but we believe in full elevation, because it is not only safer but a much better riding track, and the advance in the condition of track and increased average speed require greater attention to this matter.

We are decidedly in favor of easements for all curves of two degrees or over. They make the entrance to curves gradual, reduce the shock at high speed and keep the line much better. They should be put in with a transit and should be of sufficient length to carry all the elevation at the rate of about 50 ft. per inch. That is, the elevation should begin with the easement and reach full elevation at beginning of regular curve. The spiral or cubic parabola is equally good.

Where no easement curves are used, we recommend full elevation at ends of curves, running it out on tangents at the rate of 50 ft. per inch, except on reverse curves. It is unnecessary to add that uniform elevation, good line, gage and surface are as essential as the proper elevation for a perfect track.

Where they are not put in by the engineer good results can be obtained by throwing in the whole curve a given distance and flattening the ends by extending the curve beyond the ends of the original curve equal to one-half the length of easement. To get easement of a certain length as the curvature increases, the amount the original curves move in will increase.

Your committee recommends the use of the formula in mechanic's text books, viz: Elevation equals $\frac{g. v^2}{32.2R.}$ in which g. equals gage of track in feet; v. equals velocity of train per second in feet, and R. equals radius of curve in feet. The following table computed by this formula shows the elevation in inches for each curve, 1 degree to 10 degrees, and for speed of 10 to 70 miles per hour, inclusive.

TABLE OF ELEVATIONS FOR CURVES 1 DEG. TO 10 DEG., FOR SPEED OF 10 TO 70 MILES PER HOUR.

Degree of Curve.	MILES PER HOUR. 10 mi.	20 mi.	30 mi.	40 mi.	50 mi.	60 mi.	70 mi.	REMARKS.
1	1-16 in.	1-4 in.	5-8 in.	1 in	1 3-8 in.	2 1-8 in.	3 in.	Maximum Elevation about 7 in by the formula. Elevation equals $\frac{G. V.^2}{32.2R.}$
2	1-8 in.	1-2 in.	1 1-4 in.	2 in.	2 3-4 in.	3 3-4 in.	5 in.	
3	3-16 in.	3-4 in.	1 7-8 in.	3 in.	4 1-8 in.	5 1-2 in.	in.	
4	1-4 in.	1 in.	2 1-2 in.	4 in.	5 1-2 in.	7 in		
5	5-16 in.	1 1-4 in.	3 1-8 in.	5 in.	6 7-8 in.			
6	3-8 in.	1 1-2 in.	3 3-4 in.	6 in.	8 1-8 in.			
7	7-16 in.	1 3-4 in.	4 3 8 in.	7 in.				
8	1-2 in.	2 in.	5 in.	8 in.				
9	9-16 in.	2 1-4 in.	5 5-8 in.	9 in.				
10	5-8 in.	2 1-2 in.	6 1-4 in.	10 in.				

GARRETT DAVIS,
G. W. MERRELL,
H. G. HETZLER,
JNO. DOYLE,
Committee.

FROGS AND SWITCHES.

It is very essential that all roads should adopt some form of frog and switch as a standard, for use at all places except where some special design of construction is necessary, in order to satisfactorily meet the demand. Where railroads do not manufacture their own frogs, switches and crossings, it is well to furnish frog makers with a complete set of their standard blue prints and specifications, but in the event of special frogs, etc., careful measurements should be taken and blue prints furnished accordingly.

For main line work we would recommend spring rail frogs not less than 15 ft. in length, and in yard work, wherever practicable, would suggest the use of spring frogs of not over 12 ft. in length; variations from this, of course, depend greatly upon the circumstances under which the work is to be laid out. Where a rigid frog is adopted for such work with a heavy traffic, a bolted and filled frog with ¾ in. steel plates is certainly preferable and more economical. A great deal depends, however, as to the kind of frog to be used, which can only be determined upon under the existing circumstances.

The clamp frog may be utilized to advantage in main line service where traffic is light; the great objection, however, to this frog is its inability to support itself; the clamps naturally become loose, in consequence of which the wing rails receive the weight of passing traffic, the point drops below the surface of the wing rails, causing them, sooner or later, to become battered and useless. The only advantage gained in the use of the clamp frog is that when one wing rail is worn it admits of the frog being transposed, or it may remain in its former position and a new wing rail be substituted at a small cost, thus prolonging the life of the frog. In complicated yards where a large number of switches and frogs are necessary this style of frog cannot be used to good advantage on account of the long ties, as the clamps project below the base of the frog, requiring a greater spacing of the ties or shorter ones used; whereas a frog with a plate can be used under any conditions. In yard work where sharp curves are necessary we would recommend a frog 12 ft. in length; owing to the fact that frogs placed in curves of low radius require a wider throat and flangeway, consequently the space from outside of guard rail to point is greater in order to allow the wheel flange to pass through without binding, overcoming the battering and pounding down of the entire frog. The clamp frog, for the time being, gives but little trouble, it being void of bolts and rivets to become loose, but it is on the whole a very expensive frog as a result of its loose method of construction, there being no support whatever to the point. On the other hand the bolted frog with three-quarter inch steel plates, made in proportion to the size of the frog, has a tendency to equally support it through its entire area of bearing and is certainly the more economical. While spring frogs in yard construction may or may not be as economical as the bolted and filled frog, we do not consider it good policy to make a general use of them in freight yards where a

great amount of switching is required, as switchmen are liable to have their feet caught in the frog.

The object to the double rigid frog, as usually made, is that the wheels are furnished with no guard in passing from one point to the other. In order to overcome this difficulty it is well to have the guard rail of the frog so made that it will shade both points one-eight of an inch; in this manner one frog will answer as a guard for the opposite frog while trains are passing through the combination. Rigid double frogs up to one in seven can be used on combinations of eight degrees and ten minutes. In combination switches above eight deg. and ten minutes we would recommend the use of movable point frogs. We call attention to a guard rail in which two clamps are made use of on either end which hold the rail rigid and overcome the possibility of the rail turning over. Bends in either end have a tendency to crowd the wheels gradually through the frog, preventing them from striking the point, reducing to a minimum that sudden shock which would otherwise be the result in the use of the ordinary guard rail.

For main line passing track a one in eleven spring frog is recommended. For yards and miscellaneous sidings it is impracticable to adopt a standard frog as all depends upon the location and amount of room at disposal. Since the adoption of interlocking at railroad crossings, allowing trains to pass at full speed, the expense is consequently materially increased, requiring as they do a greater amount of care and attention as a matter of perfect safety. A railroad crossing should be placed in such a manner as to be perfectly rigid and the least expense will be incurred in the maintenance of such a crossing. In order to accomplish this it is advisable if the circumstances will admit, to have at least four feet of rock foundation framed with timbers of suitable kind and size and a properly constructed drain from the bottom of the pit, and if properly built with constant use this can be cared for the year round at no great expense of maintenance.

Switches in main tracks should be put in with a theoretical lead corresponding with the theoretical switch point, in accordance with the angle of the frog, and where a fifteen foot switch point is used, as is very often the case, the length of the lead should be shortened the difference between the theoretical switch point and the fifteen foot point, which will make the lead practicable. Where a fifteen foot switch point is used as a standard for yard work the leads can be shortened; for instance, a one-in-fifteen frog can be used on any lead from one hundred and fifteen to one hundred and thirty-two feet. One-in-ten frogs are often used as a standard in connection with a one-in-nine lead. Then why not not use a one-in-nine frog with a lead to correspond, as it certainly would be practicable, furnishing as it does a perfect curve in making use of a frog one size less and would last longer than a No. 10 if a rigid frog? J. HEY

DITCHING.

Proper attention to the drainage of railroads has, like a strong anchor, saved many a man and train from shipwreck; it is therefore, not to be wondered at that road masters wish to be often reminded of this most important matter. Whilst there is a general desire for action and information upon this subject among all of us, it must be admitted that we have yet a great deal to learn, and this very ignorance is mainly due to a lack of teaching and training from those who know the real meaning or philosophy of the art. As nearly every road has its own standards in regard to cross section and shape of road bed and ditching, it hardly seems necessary (as is often done) to attach to this paper, plans showing how track should be ditched. It is an old subject. The main object is to remind the road masters of the great importance attached to this matter: that economy in track maintenance begins right here; that one of the most important factors in prolonging the life of cross ties and saving the rails rests with good drainage. Good ditching shows for itself and tells its own story,

Our managers should never grumble or hesitate as to the security derived and money saved in allowing the roadmaster sufficient forces to keep his track well drained. One or two day's rain will often spoil weeks and months of hard work by the section foreman by neglect of this kind. In ballasting or other important track work, great attention should be given to the matter of drainage; every ditch should be amply large to carry off all the water that will ever come into it and sufficiently deep to keep the moisture away from the ties and ballast. Frequently on new roads, cuts will slide in and sometimes make the track impassable; this is often prevented by a good surface ditch on top, placed some distance back from the top edge of the cut as circumstances will admit. In cases where this will not stop the sliding, the writer has known bad cases cured by cutting vertical trenches on the slope of the cuts from top to bottom, placed about 20 ft. apart, as the case demands, with the dirt mounded up in oval shape between the trenches. This is a good remedy where the earth seems to be alive and constantly on the move.

A great many roadmasters seem to think that it is not necessary to spend any money draining banks? This is a mistake, banks should be properly drained as well as cuts. Rough track is often found on embankments caused by the ties being buried in mud. This is wrong; ties on embankments should have free drainage from their ends, on a slope of at least one inch in 12 inches. We often meet with material in cuts of a spongy or boggy nature, where even rock ballast will not keep the track smooth. I have seen bad cases of this kind cured by putting porous tiling in the side ditches and cinder ballast at least 12 in. deep under the ties. Where places of this kind are encountered in cuts there is no end to the trouble and if the grade of the rail road can be changed to at least 6 in. to the 100 ft. it will often give permanent relief.

We often hear the question raised: "How much time of a section gang should be given to ditching?" This can best be answered by the circumstances governing the case. In the proper seasons for this kind of work, and where sufficient help is allowed, it is considered good practice to give at least one fourth of the time to the matter of ditching.

In conclusion, it must be apparent to every roadmaster, or any man who has ever had charge of the maintenance of way, that the fundamental principles of having good track is to have good and through drainage—absorption is a slow process—and give the old section boss his share of credit when he said: "Keep the water running, take care of the ditches and the track will take care of itself."

J. M. MEADE.

BALLAST.

1. What is the best kind of ballast.

We find that ballast made from stone, crushed to the proper size for tamping, that will neither solidify in track, nor disintegrate while being worked, makes the best ballast. The term gravel, as ordinarily used, applies to so many different kinds of material that, in alluding to it, an explanation should follow each statement describing the quality of the gravel in question. We have seen gravel in small quantities, generally in pockets, that was clean hard stone; ranging in size from that of a pea to a hulled wallnut. No material could be better for ballast than this, but, owing to the amount of soil and fine sand that is usually put in track with the gravel, we find it inferior to crushed stone.

There is no doubt that burned clay has many qualities to recommend it for ballast. Those who have used it the longest are the most enthusiastic in its praise. Furnace slag makes very good ballast. and the same may be said of locomotive cinders under certain conditions.

2. What are the best methods for handling different kinds of ballast?

The methods of handling ballast differ under different conditions and localities. What would be economical in one case, would be expensive in another. Stone is generally moved from the quarry to the crusher by small dump cars on an inclined railway, attached to cables. Where it is convenient to locate the crusher about level with the quarry, parties who move the stone with dump cars claim that they can do it more economically than with cars. After the stone is crushed, it is elevated and put into storage bins, convenient to load into cars by gravity. The distribution of crushed stone on track can best be done with hopper bottom cars. The Roger ballast car is, perhaps, the most complete car for this work that is in general use. Gravel can generally be more economically loaded with steam shovel than in any other manner. It can best be handled in hopper bottom cars also, or may be distributed with good success on flat cars, when the haul is not too long, and unloaded with the rapid unloader. Furnace slag and locomotive cinders may be handled the same as gravel.

3. What is the best kind of cross section for each kind of ballast, both as to road bed and ballast?

The best cross section is the one which will keep the destructive elements farthest from the track. Road beds should be wide enough to reduce the heaving of the track to a minimum. They should be drained below the frost line in all clay cuts. Where it cannot be done by open ditches, it may be successfully done with tiling. Whether drainage is made in open ditches or under ground, it should be done with the view of getting the water away from the track as quickly as possible.

W. H. COURTNEY,
T. HICKEY,
Committee.

NOTICES OF PUBLICATIONS.

A number of copies have been received of the monthly publication entitled "Compressed Air". This is in the form of a small pamphlet and is devoted to the useful application of pneumatic power. In view of the great number of mechanical processes which are conducted with the assistance of this power, it seems to have a wide field of usefulness. The publication is 5¾x8½ in. in size and it is well arranged and edited. The object of the publishers, as may be gathered from the issues already out, seems to be to bring out the fact that compressed air may be applied practically to an ever increasing number of mechanical operations, and to assist in presenting such information as will enable engineers to adopt it with satisfactory and economical results, great stress being laid on the economy of operation. There is no doubt that the extension of pneumatic power is to be rapid and that it is destined to become still more a useful agent, and it is important that all the information to be obtained from tests and investigation should be available for the guidance of engineers employing it. The presentation of such information has been very well begun in the first issues of this journal which has been improving in value since it started. The office of publication is at 26 Cortlandt street, New York, the price being $1.00 per year.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF RECEIPTS, NOTES AND QUERIES, edited by Albert A Hopkins; cloth; 708 pages; illustrated; New York; Munn & Company. Price $5.00.

This work contains a compilation of the receipts and replies given in the "Notes and Queries of Correspondents", as published in the Scientific American during the past 50 years, with selection of those which are considered the most useful. The receipts number over 12,000, covering many branches of useful arts. In addition to the reprints from the columns of the Scientific American, the works of Cooley, Spen, Gardner, Crookes and others have been consulted, and quotations made therefrom. It is a comprehensive work and contains a large amount of information, much of which is given without stating the source and which therefore may be considered of doubtful value. The compilers, however, evidently attempted to give this information as the source from which some of the receipts were taken, have been recorded.

MASTER CAR BUILDERS' ASSOCIATION; Report of the proceedings of the 30th Annual Convention held at Saratoga, New York, June, 1896.

The 30th volume of the proceedings of the Master Car Builders' Association has just been received from the secretary, Mr. John W. Cloud. This volume is a great improvement over previous issues, both in regard to the quality of paper used and the binding. The binding this year is half leather and is in a form which is appropriate considering the valuable contents. The usual list of officers, standing committees, subjects for the next convention, list of members and the constitution precede the report of the proceedings, and a new feature is added in the form of a list of the conventions and the locations which is put next to the title page. At the end is the usual set of plates showing the standards of the association which are folded in the customary manner, and an improvement which will be found exceedingly convenient in examining these plates consists in numbering them on the lower right handcorner, which permits offinding the one desired without unfolding it, and probably a number of others before reaching the one wanted. The work closes with a sheet giving the details of the letter ballots cast in 1896, the number of questions decided in this way being 43. The index is more complete than that of last year and is the result of a good deal of hard work which will be appreciated by those having occasion to refer frequently to the volume. The letter press is good and the whole appearance of the work is a credit to the secretary. The proceedings in this form will be given a place beside those of other technical societies of the highest standing.

A TREATISE ON SURVEYING, COMPRISING THE THEORY AND THE PRACTICE, by Wm. M. Gillespie, L. L. D., formerly professor of civil engineering in Union College. Revised and enlarged by Cady Staley, Ph. D., president of Case School of Applied Science. Part 1, Land Surveying and Direct Leveling. New York, D. Appleton & Co., 1896, 8 vo., cloth, 551 pages, including tables with illustrations. $2.50.

Gillespie's Land Surveying has long been used as a text book and is, therefore, well known. In the preface to the original work, the author announced that another volume on leveling and higher surveying was to follow. This work was unfinished at the time of his death. It was completed by Prof. Staley and published in 1870. In 1887 the two volumes were revised and united into one and the demand for a more complete treatment of higher surveying for the use of students in technical schools together with the rapid development of these schools have made it necessary to enlarge the more advanced portions of the book. In view of this and the fact that the two parts will be used separately it has been decided to republish it in two separate parts, Part 1, which is the one under consideration, being devoted to plain surveying, including land surveying and direct leveling, while Part II, treats of higher surveying and will include trigonometric leveling, barometric and precise leveling, topography, geodesy, field astronomy, hydrographical surveying, mining and city surveying and other special topics. By this arrangement, those who desire only the land surveying and direct leveling may have it without the other, and those who wish to take the more advanced work can include Vol. II. The preface states that the best authorities have been consulted in order to render the work as reliable as possible. The book contains a general division of the subject and also an analytical table of contents. It contains the usual logarithmic and other tables connected with the subject.

The number of Darlington's Hand Books, published by W. J. Adams & Sons of London, England, has been increased by the addition of one entitled "Jersey; What to See and How to See It." As these convenient little handbooks have been previously noticed in these pages it is only necessary to state that this one is up to the standard of excellence of these works, and it should be procured by persons intending to visit the Channel Islands.

OUR PATENT RECORD.

(Our record of patents that most interest our readers is compiled regularly by our Washington correspondent with the idea of being a complete index. Space forbids more than the citing of a reference, but the complete specification or drawing of any patent desired will be mailed to any address upon receipt of 10 cents in stamps, and other information in regard to patents will be cheerfully given. Address all communications to our correspondent, Edw. C. Weaver, Attorney and Counselor, McGill Building, Washington, D. C.)

567,579, car truck frame, Edward Cliff, Newark, N. J., filed June 11, 1896. Serial No. 595.099 (no model).

567,617, locomotive, Jean P. Serve, Lyons, France, filed Oct. 9, 1895. Serial No. 565,147 (no model). Patented in France Jan. 7, 1892, No. 218,482, and March 15, 1892, No. 220,144.

567,632, metallic railway-tie, Samuel F. Adams, Brooklyn, N. Y., filed Jan. 3, 1896. Serial No. 574,247 (no model).

567,665, railway-switch, Conrad Hoerl, Newark, N. J., assignor of one-half to Stephen J. Meeker, same place, filed May 28, 1895. Serial No. 550,915 (no model).

567,653, culvert, William S. Parker, Austin, Texas, assignor of two-thirds to Otto Bergstrom and Robert M. Armstrong, same place, filed March 25, 1896. Serial No. 584,865 (no model).

567,657, railway gate, William G. Roome, Jersey City, N. J., filed Nov. 17, 1893. Serial No. 491,256 (no model).

567,673, Journal and journal-box for railway trucks, Alfred D. Abbenzeller and Hiram S. Faunce, Randolph, Mass., filed Jan, 9, 1896. Serial No. 575,032 (no model.)

567,678, car coupling, Joseph Callantine, Peru, Ind., filed Sept. 8, 1894. Serial No. 522,523 (no model.)

567,753, railway crossing signal, Charles Selden, Baltimore, Md., filed April 21, 1896. Serial No. 588,434 (no model).

567,770, car coupling, Charles S. Park, Montague, Mass., filed Oct. 8, 1895. Serial No. 565,028 (no model).

567,819, combined seat and berth for railway cars, etc., Sigvald Udstad, St. Charles, Mo., assignor to the St. Charles Car Co. of Missouri, filed May 27, 1896. Serial No. 593,237 (no model).

567,866, car coupling, Henry Schaeffer, Farmington, Iowa, assignor of one-third to Newton J. Headding, same place, filed March 20, 1896. Serial No. 584,155 (no model).

567,873, rail fastening device, Francis W. Wilson, New York, assignor to W.H. Gould and Isaac F. Roe, Newark, N. J., filed June 25, 1896. Serial No. 596,898 (no model).

567,880, door for refrigerator cars, Charles Bouchard, Chicago, filed May 16, 1896. Serial No. 591,843 (no model).

567,902, car coupling, Adolph F. Kuhlmann, La Cross, Wis., filed Jan. 28, 1896. Serial No. 377,130 (no model).

567,911, station indicator, Otis J. Merritt, Seneaguoteen, Idaho, assignor of one-half to John J. Costello, Cœur d'Alene, Idaho, filed April 11, 1895. Serial No. 545,322 (no model).

PERSONAL.

Dr. A. A. Freeman of Erie, Pa., has been elected president of the Erie & Eastern road.

Mr. J. P. Beckwith has assumed the duties of traffic manager of the Florida coast lines.

Mr. George E. Abbott has been appointed general passenger agent of the passenger department of the Union Pacific, with headquarters at Sioux City, Iowa.

Mr. R. H. Ingram, who was with the Louisville & Nashville for several years, will, it is said, in a few days go to Canada to accept a position on the Grand Trunk.

Mr. Edward Battey, chief clerk of the late George B. Sherman, has been appointed acting general manager of the Vanderbilt fast freight lines until a successor to Mr. Sherman is appointed.

Mr. S. J. Henry, formerly assistant general freight agent of the Missouri Pacific, has been appointed to the same position with the Rio Grande Western, with headquarters at Salt Lake City.

Mr. E. W. Hiner has been appointed assistant general passenger agent of the Lima Northern road. Mr. Hiner already holds the positions of general agent of the Ohio Southern and Lima Northern.

Mr. Edwin Hawley has received the appointment of general eastern agent of the Pacific Mail and the Occidental and Oriental steamship lines, which work in connection with the Southern Pacific system.

Mr. S. D. Parkhurst, formerly chief clerk of the St. Paul & Duluth freight department, has gone to Fort Dodge, Iowa, where he will immediately assume the duties of general freight agent of the Mason City & Fort Dodge.

After an absence of five months Mr. F. L. Shepperd, superintendent of the Pennsylvania lines east, with headquarters at Altoona, on Monday assumed charge of his office and is in much better health for his trip abroad.

Mr. C. C. Sholes, for some years past assistant superintendent of telegraph on the Santa Fe, owing to the death of Superintendent Gemmell is to have supervision and direction of the telegraph department of the Santa Fe.

Mr. Thomas L. Collins, chief rate clerk to Assistant General Freight Agent Haiden Miller of the Southern, succeeds Mr. M. M. Ansley, soliciting freight agent of the Great Southern Dispatch Line in Atlanta. Mr. Ansley goes to Rochester, N.Y., to represent the same line.

Mr. J. Morton Hall. formerly general passenger agent of the Allegheny Valley Railroad and well known in railway business circles, accidentally shot and killed himself at his residence in Allegheny on the morning of Sept. 16, while cleaning his revolver.

An official circular has been issued by Mr. D. I. Roberts, general passenger agent of the Erie, announcing the appointment of Mr. John D. Cutter as traveling passenger agent, with headquarters at Youngstown, O. Mr. Cutter succeeds Mr. F. A. Beatty, resigned.

Mr. W. H. Hudson, formerly master mechanic of the Southern Railway in Atlanta, has been promoted to be master mechanic of the new shops at Salisbury, N. C. The Salisbury shops are the largest on the Southern Railway and among the largest in the country.

Mr. W. A. Tuley, for many years traveling passenger agent for the Atchison, Topeka & Santa Fe, has resigned to accept a similar position with the St. Louis & San Francisco, with headquarters at Dallas, Tex. Mr. Tuley will have authority to represent the Frisco in Texas in all passenger matters.

General Edwin Wadsworth, for a nnmber of years commercial agent of the Chicago, Burlington & Quincy, and later general agent of the Erie and Northern Pacific, died September 14, in Chicago at the age of seventy-two. He had been ill two weeks. Death resulted from a complication of diseases brought on by a severe cold.

Mr. Thomas Somerville, superintendent of the Fairland, Franklin & Martinsville, died at Indianapolis last Wednesday, as the result of an operation for the removal of a carbuncle on his neck. He has been superintendent of the road, which is a branch of the Big Four, for eight years and was well known among railroad men. He began service with the Big Four in 1865. He was 50 years old.

Mr. B. H. Akin, who was general passenger agent of the Columbus, Sandusky & Hocking under the Monsarrat administration, has taken service with the Baltimore & Ohio as special agent of the passenger department to look after excursion business to and from Canton, the travel being so heavy over the Baltimore & Ohio that the passenger department found it necessary to have a special agent to look after it.

Mr. H. F. Moeller, formerly district passenger agent of the Flint & Pere Marquette at Detroit, has been promoted to the position of assistant general passenger agent of the same road with headquarters at Saginaw, Mich. Mr. Moeller has been connected with the Flint & Pere Marquette for fourteen years. His first passenger work was in 1888, when he traveled for the road in Canada, being assigned other territory from time to time, until his appointment at Detroit.

Mr. R. B. Gemmell, superintendent of telegraph of the Santa Fe Railway system, died at Topeka, Kan., on the morning of September 14, of pneumonia, aged 57 years. When a young man Mr. Gemmell was connected with the telegraph department of the Pennsylvania Railroad. In 1866 he went to Kansas to take the position of superintendent of telegraph of the Kansas Pacific road, and later was appointed general passenger and ticket agent of the same road, with headquarters at Lawrence. He has held for many years the position at the head of the telegraph department of the Santa Fe system.

Ex-President James M. Ashley of the Ann Arbor, who died at Alma, Mich., yesterday, was the founder of the road of which he was the chief executive for many years. Mr. Ashley commenced the construction of the railroad in 1878 without capital. The road was built from Toledo to Ann Arbor and afterwards extended to Frankfort. Mr. Ashley relinquished the presidency and when death overtook him he was writing reminiscences of his political career. One of Mr. Ashley's sons is H. W. Ashley, now general manager of the Ann Arbor, and James M. Ashley, Jr., former vice president of the same road.

Mr. Matthew L. Steele, formerly of Bloomington, died September 14, in Chicago, aged 63 years. He was one of the oldest telegraph operators and one of the first train dispatchers of the United States. He went to Bloomington in 1855, and took the management of telegraph office of Caton lines, being the second manager in that city. Soon after he entered the service of the Chicago & Alton and became one of the first men to move trains by telegraph. After twenty-five year's continuous service for the Alton in Bloomington he was retired on a pension and moved to Chicago. The death was occasioned by paralysis, beginning as operators' palsy of the arm and being finally complicated with dropsy.

At the annual meeting of the stockholders of the Louisville, New Albany & Chicago Railway held at Indianapolis, Ind., Sept. 16, Mr. J. A. Hilton was appointed a stockholder to succeed Mr. E. K. Sibley, deceased. The board of directors now consists of Messrs. W. H. McDoel and Gilbert B. Shaw, Chicago; Calvin S. Brice and James Murdock, Joseph H. Boyd, E. Connor, John Greene, Frank R. Lawrence, John G. Moore, Samuel Thomas, E. R. Thomas and H. H. Campbell. The directors will elect the following officers: President, Samuel Thomas; vice president, John Greenough: vice president and general manager, W. H. McDoel; secretary and treasurer, W. H. Lewis: assistant to the secretary and treasurer, J. A. Hilton; auditor and purchasing agent, J. H. S. Raig; general superintendent, George K. Lowell; general passenger agent, Frank H. Reed, general counsel, George W. Krutzunger; general solicitor, E. C. Field.

Mr. Alexander C. Bryant who for several years was general yardmaster of the Chesapeake & Ohio at Indianapolis, Ind., and later held the position of general agent of the same road at Clifton Forge, Va., died very suddenly at the latter place September 13. Mr. Bryant began railroading in Indianapolis as switchman on the Bee-Line, in 1857 becoming yardmaster at the same point. One year after the war broke out he was appointed by the government superintendent of the roads which had fallen into the hands of the government. At the close of the war he came north and was appointed yardmaster of the Indianapolis, Bloomington & Western. This position he held some years and then accepted a position at the Indianapolis live stock yards, which position two years later he resigned to accept the position of general agent of the Chesapeake & Ohio at Clifton Forge, which position he filled with ability up to the day of his death.

RAILWAY NEWS.

"Alley L."—The South Side Elevated road in Chicago was sold at public auction on Thursday, Sept. 10, to Messrs. Leslie Carter and George E. Adams, representing the first mortgage bondholders' protective committee respectively, the price bid being one hundred dollars over the upset price of $4,000,000. The suit of foreclosure under which the sale took place was filed in October, 1895, at the end of a six months' default of interest on the part of the company on the first mortgage bonds. Interest on the second mortgage bonds was three months overdue, and the "Alley L" Company acknowledged a default and allowed the holders of the second mortgages to become a party to the suit. There are two issues of bonds outstanding. The first, known as first section bonds, amounting to $7,500,000. These bonds are secured by a mortgage covering the part of the road extending from Congress street to Sixty-third street. There is a second mortgage which is a first lien upon the Sixty-third street extension and a second lien upon the main portion of the road. This makes the bonded indebtedness of the company $10,500,000. There is a stock issue of $7,500,000. Plans of reorganization are expected to be completed in the near future. It is stated that electricity will be substituted for steam power and the property thoroughly renovated.

Atchison, Topeka & Santa Fe—The Santa Fe management having, it is said, concluded that railroad companies should not be engaged in private enterprises, has for this reason disposed of all its coal mines in the west. The Colorado mines owned by the company were leased a month ago to the Colorado Fuel & Iron Co., which now operates them. Mr. C. J. Devlin, manager of the company's coal properties in Kansas, has bought all of the mines in that state and will take possession October 1. His purchase includes the Santa Fe mines in Osage, Cherokee and Crawford counties. He also owns the mines at Marceline, Mo., and Toluca, Ill., from which the Santa Fe gets a large part of its fuel. This sale closed out the last of the Santa Fe's coal properties. The price paid is not stated.

Columbus Southern.—At the request of the bondholders who do not want the property placed on the market until after election, the sale of the Columbus Southern road has been postponed until December. The hope is that at that time business conditions will be more settled than at present.

Detroit, Lansing & Northern—Grand Rapids, Lansing & Detroit—The date advertised for the sale, under mortgage, of the Detroit, Lansing & Northern and Grand Rapids, Lansing & Detroit, a leased line, is October 20. It is understood that thereafter the system will be known as the Detroit, Grand Rapids & Western.

Duluth Transfer R. Co.—The Metropolitan Trust Co. of New York has brought suit against the Duluth Transfer R. Co. to compel the payment of $35,490 due as interest money January 1, 1896, on the mortgage held by that corporation of the property of the railway, as a receiver is applied for.

Galveston, Houston & Henderson.—On Sept. 8 a consultation was held at Galveston, Tex., between Messrs. F. M. Campbell, general manager of the International & Great Northern, T. C. Purdy, general manager of the Missouri, Kansas & Texas, and J. H. Hill, general manager of the Galveston, Houston & Henderson, relative to improving the latter road so as to accommodate the increased traffic of those roads seeking an outlet at Galveston. At present the facilities of the G., H. & H.—which is operated jointly by the above companies—for handling increased business is totally inadequate. If the proposed improvements are carried out, it is likely $100,000 will be expended in enlarging the terminal facilities in Galveston and Houston, and in extending the switches and sidings along the line. It is thought probable the passenger equipment of the line will also be improved. The details of the proposed improvement will not be made known until plans are submitted and approved by the executive boards of the respective companies.

Great Northern.—The extension to the Hope branch of the Great Northern, which is being built from Hope, Steele county, to Aneta, Nelson county—30 miles—will be completed by the middle of October.

Work will begin this week on the extension from Crookston to Halstad, a great deal of construction material being already on hand at Moorhead awaiting shipment to the scene of action. A sidetrack will be built at Halstad on which to set out the cars loaded with material, and tracklaying will commence at once. The unloading and laying of the rails will be done by machinery, and it is expected the work will be finished in 30 days. Foley Bros. & Guthrie of St. Paul have the contract for this new line.

Gulf & Ship Island.—On September 11 the Gulf & Ship Island completed its line from Gulfport to Hattiesburg, the last rail being laid near Black Creek that evening. This road, which has been built by the Bradford Construction Co. under Mr. S. S. Bullis as general manager and Mr. D. M. O'Neil as superintendent, is 71 miles long, and all the rails with the exception of 20 miles, which were laid a number of years ago, have been laid since January 1 of the present year. The rails laid this year are 60 lbs. and those previously laid are 56 lbs. The completion of this road connects the gulf coast to the state of Mississippi and is the consummation of the efforts of over 50 years.

Houston East & West Texas.—It is said to be the intention of Blair & Company, who purchased and assumed control of the property of the Houston East & West Texas in June last, to take it out of the class of purely local properties and develop its traffic in exchange with connecting roads. It is believed this can be done, as the geographical position of the road and the character of the business of the country it penetrates are such as to aid the change. This exchanged business will be wholly gain to the road, and it is expected to be available as soon as the condition of the property has been raised to the standard of its connections. Mr. House, who is now president of the company thinks that, if reorganized as proposed, it can very materially extend its operations.

Licking Valley.—It is stated that the Licking Valley road will be completed in about two weeks. This present line will be operated from a point on the Chesapeake & Ohio in Bath county to what is known as Beaver creek all in Kentucky, a distance of about 11 miles. It is also stated that right of way has been secured for an ex-

tension of 15 miles to connect with the Covington, Fleming & Ashland, a narrow gage line terminating at Hillsboro in Fleming county, and at the other end a line to tap the Caney coal fields in Morgan county. Mr. A. Eaton of Winchester is president.

Louisiana.—According to the New Orleans Picayune there is a great deal more being done in the way of railroad development of Louisiana than most people know. In an interview with Mr. E. Daboval, secretary of the Central Louisiana road, that gentleman is quoted as saying: "The Central Louisiana road, a line which has been projected for some time, but upon the building of which operations have not yet been started, is meeting with much more encouragement from the people than usual, and the prospects are that in a short time the proper rights of way will have been secured and active work begun. This road will run from Palmetto, on the Texas & Pacific,down through St. Landry parish, which is a rich parish, to Crowley, crossing the Southern Pacific there, and from that point making a settlement known as Red Hills, from which it proposes to run direct to Abbeville, a line in all, from Palmetto to Abbeville, of some 75 or 80 miles in length. The road will thus penetrate a very fertile section of country, one where the rice business is already flourishing and one where cane may be produced in large quantities. The road will cross the Southern Pacific twice in making the Abbeville terminal, or, rather, the Southern Pacific proper once at Crowley, and the Alexandria branch at or near Washington. The new road will, from Abbeville, seek to secure a port at Vermillion bay, some 25 or 30 miles distant to the southward. It may not be a fact generally known, but Vermillion bay promises to afford one of the best harbors all along the gulf coast, and with very inconsiderable outlay of capital can be reached and utilized." Mr. Daboval also says that he has every reason to believe the trouble which has been experienced during the past year or so in securing certain desirable rights of way will be overcome, and the road started. Ex-Senator Hampden Story is president of the new road. Mr. Daboval is secretary and ex-Deputy United States Surveyor Wm. Bradford is the surveyor, who is now looking after the rights of way through the swamps.

New York, New Haven & Hartford.—A public statement of the affairs of the New York, New Haven & Hartford Company for the year ending June 30, 1896, has just been issued in the form of its annual report. The report shows a total gross earning from operations of $30,345,630.10. By deducting the operating expenses of 69.65 per cent., $21,-137,226.59, the income from operating is $9,208,403,51. Income from other sources amounts to $855,685.98, making a total income of $10,064,089.49. Other deductions from income, such as taxes, interest, and rentals, leave a balance of income applicable to dividends $3,666,892.09. Dividends paid $4,608,542. Surplus for the twelve months, $58,350.09. These earnings show continued growth and prosperity by an increase of 8¾ per cent, which reduced to figures, make an increase of $,443,894.31. The statement then proceeds to a report of the various improvements made, and new roads required.

Norfolk & Western.—The main line of the Norfolk & Western road, extending from Norfolk to Bristol, was sold at public auction at Norfolk on September 15 by special masters Charles Sharp and George E. Bowden. The purchasers were George Coppell, J. Kennedy Todd, Victor Morowitz, and W. E. Glynn, representing the reorganization committee of the bondholders. There was only one bid amounting to $3,000,000. The Shenandoah Valley division was sold on Wednesday morning September 16 at Roanoke, Va., to the same committee for $1,500,000. In the afternoon of the same day the Durham division was sold. The only bid was one of $500,000 made by the bondholders' reorganization committee.

Ohio Southern.—The Ohio Southern Railroad, which has for some time been in the hands of a receiver was on September 14, ordered sold. The sale will be subject to the first mortgage bonds, and will take place some time this fall. The Ohio Southern road extends from Wellston to a distance of about 200 miles. The Lima Northern road is really an extension of the Ohio Southern, and it is probable they will be the purchasers,although the name of Senator Brice is connected with the deal.

Oregon Railroad & Navigation Co.—Formal announcement is made of the formation of the Oregon Railroad & Navigation Company, comprising the property of the Oregon Railway & Navigation Company, the Oregon Railway Extensions Company, and the Washington & Idaho Railroad Company. The New York Security and Trust Company and the United States Trust Company of New York will upon presentation of the certificates of deposit, make the respective payments as required by the plan of reorganization. It is expected that the bonds of the Oregon Railroad and Navigation Company, with first coupons maturing on December 1 next, and the stock trust certificates representing the stock of said company,will be ready for delivery on or about October 1.

Philadelphia & Reading.—A bill in equity has been filed in the United States circuit court by Mr. W. W. Kurtz who it is stated, is a holder of first mortgage bonds of the Philadelphia, Reading & New England R. Co., the payment of interest of which is guaranteed by the Reading company, and upon which default has been made. This bill seeks to prevent the sale of the company's property under foreclosure of the general mortgage which is set for September 23 at Philadelphia. The argument is that the decree for foreclosure was not the adjudication by the court of any litigated controversy, but was "the mere agreement of the parties, plaintiff and defendant, to said cause, acting under the control and direction of the managers of the reorganization,for the purpose of transferring the property of the Philadelphia & Reading Co. to the holders of their bonds and stocks clear of any liability for debts, as the managers may choose to exclude from participation therein."

Pittsburgh & Western.—A statement has been made in some of the eastern papers to the effect that Mr. Andrew Carnegie is about to become the possessor of the Pittsburgh & Western road in order that he may extend it from Ormsby to Buffalo and make that port his point of shipment for the products of his mills. It is claimed that he is willing to put $5,000,000 into the enterprise and prefers to control that road rather than to connecting Pittsburgh with the Pittsburgh, Shenango & Lake Erie R., as has been contemplated for some time. It is said that Mr. Carnegie has been promised the aid of other large corporations in Pittsburgh in making the new route a success.

Washington & Columbia River.—A western exchange says it is generally understood that should the Oregon Railway & Navigation Co. extend its line from Dayton to Covello, that the Washington & Columbia River will also build in that direction, perhaps as far as Lewiston, Idaho. This territory embraces rich agricultural lands and it is thought probable that within a year both roads will have lines into that part of the country. A predicdiction was made at the time of the latest Burlington survey, that the W. & C. R. would be utilized to connect that line with the cost, and it is possibly with this end in view that this extension will be made, which, if carried out, will place Walla Walla on a main line of one of the great transcontinental roads.

NEW ROADS AND PROJECTS.

Alaska.—In the central part of the Alaskan territory lies the Yukon mining district, the inhabitants of which are very anxious for better transportation facilities and especially for some arrangement whereby they may receive more frequent mail. At present they have six mails a year, three Canadian and three American. Early in the season a meeting of the Yukon Order of Pioneers was held at Forty Mile Creek in British America, and the Canadian government was memorialized to authorize the construction of a railroad from Taku Bay to Teslin or Aklene Lake, the headwaters of the Hootalinqua river, a distance of something over 60 miles. From that point there is unimpeded steamboat navigation to the mouth of the Yukon, of which the Hootalinqua is a tributary. A part of this railroad would be in United States territory,and for this part of the undertaking the authority of the United States will have to be secured. It is claimed that sufficiently accurate surveys have been made to demonstate that there are neither engineering difficulties in the way nor expensive construction required. Such a route opened up would make the Yukon region infinitely easier of access and especially easier and cheaper to get out of it. It would be practicable then to get in or out of the country at any time during the summer season. Getting out of the country would then not necessitate the long trip down to the mouth of the Yukon to St. Michael's and then the 3,000 mile trip by sea. It is thought there would be no difficulty in securing the money to build the road if the right to build it could be secured. The Yukon region undoubtedly has a great future in the development of its mineral resources. The mining so far, according to a recently returned correspondent, has all been placer mining, but quartz is beginning to be discovered. As to the climate this gentleman says: "It gets cold in the winter but there are no severe storms. No one in good health will suffer. There are at least a dozen women with their husbands in the Forty Mile Creek region and I guess fully as many in the Circle City region. The Indians of this region are the best Indians in the world. They are good workers and trustworthy. Dogs are an absolute necessity for packing commodities in winter. About seventeen horses were brought in this season, but I doubt if they will be of much use in winter".

California.—Articles of incorporation have been filed in the county clerk's office at San Francisco for a company which will be known as the Sierra Pacific R. Co. The company intends building a road from Stockton to Jackson, Amador county, with branches about 50 miles in length running to San Andreas, Campo Seco and the Plymouth Rock mine in Calaveras county. A line of steamers will also be operated between San Francisco and Stockton. For the first year the following directors will serve Messrs. B. F. Langford, P. A. Buell, W. A. Shippee, B.W. Moore, George A. Brown, Jr., D. A. Robertson, and M. J. Gardner, all of Stockton, Cal. The road will be standard gage with a capital stock of $2,000,000, of which $60,000 is already subscribed.

Maryland.—The surveys for the proposed Washington, Annapolis & Chesapeake road are about completed. This road which is to be about 26 miles long running from Washington to a point on Chesapeake Bay near the mouth of the Severn river, will be run in connection with steamers to reach the eastern counties in Maryland and the Atlantic coast. Mr. L. H. Hyer of Washington is chief engineer. Capital stock is said to be $500,000.

Mexico.—A survey has just been completed of the Mexican road which, it is reported, is to be built by Mr. C. P. Huntington and operated in connection with the Mexican International at Durango which is owned by Mr. Huntington, as well as the Southern Pacific system in the United States. It is said to be the intention to extend the line from Oaxaca to Durango passing through the City of Mexico. It is also reported in this same connection that Mr. Huntington has purchased from Pearson & Sons the lease granted them by the Mexican government for the operation of the Tehuantepec road for a term of years. By the building of the connecting link of road Mr. Huntington will have a through line from New York and San Francisco to the Isthmus of Tehuantepec, and will control the water situation, as he will operate his Pacific mail steamers in connection with the Tehuantepec railroad. The uncertainty of financial affairs in the United States is given as the cause of Mr. Huntington's determination to make heavy investments in Mexico.

Pennsylvania.—The North Shore railroad is the name of the new concern which is to build a line from 16 to 18 miles in length which will connect the Pittsburgh & Lake Lake Erie at Beaver Falls with the Pittsburgh & Western at Calley Junction. The manufacturers of the Beaver Valley in Pennsylvania are seeking another traffic outlet to increase their transportation facilities and this line is the outcome of their efforts. It has been known that the Baltimore & Ohio R., through its Pittsburgh & Western line, has been for years seeking and entrance into the valley to get a share of heavy hauling, but has been unable to get the right of way. The North Shore R. Co. will be independent of the Pittsburgh & Western R. The Pittsburgh, Fort Wayne & Chicago R. will be crossed above grade at Conway.

A survey has been made for a new railroad from Loretto, Cambria county, Pennsylvania, to Cessna, Bedford county, a distance of about 30 miles. Engineers have been on the line for two years, but only recently was the present route decided on. Seven lines were run in the Allegheny mountains in the effort to find an easy pass over the summits. This has been finally accomplished, but a long tunnel and heavy fill will be necessary. The first survey of this route was made in 1873.

INDUSTRIAL NOTES.

Cars and Locomotives.

—When the Madison Car Works shut down it had on hand an order for cars for the Lake Shore & Michigan Southern, for which much of the material had been bought but on which no work had been done. It was anticipated that the order would be transferred to some other car works, but we understand that it has simply been cancelled, and the railroad company will not order any cars at present.

—The Chattanooga Car & Foundry Co. has a big job on hand repairing a lot of iron cars for the Southern Railway.

—The shops of the Union Pacific Railway, built in Denver in 1892 and never very fully operated, are almost models of excellence in the general layout and construction of the buildings. The repair yards are large, roomy and convenient. The buildings are light, well heated and ventilated, and are provided with air hoists. Only a small amount of work is now in progress there; and much of this is for the Union Pacific, Denver & Gulf. A combination car being built there for the latter road is nearly completed. Two new narrow gage passenger coaches have just been received from the St. Charles Car Works and were put into immediate service. They are provided with Wand's Little Giant side roller and spring bearing. This bearing has been used for some time by the Union Pacific, Denver & Gulf Railroad, and is considered by them a highly advantageous device, especially for mountain roads and others having numerous curves. The Denver shops are in charge of Master Mechanic L. V. Sprigg. Superintendent of Motive Power M. F. Egan and Mr. F. E. Fowler, master car builder of the U. P., D. & G., have their offices here, although much of the work under their charge is done at Trinidad and other points on the line.

Bridges.

—The Norfolk, Va., city authorities will let the contract for building a steel bridge over Smith's creek at the extension of Granby street, as soon as the necessary consent of the Norfolk & Western Railroad Co. can be obtained. This bridge is to be 100 ft. by 50 ft., with brick abutments. The council has already appropriated $10,500 towards defraying the cost of its construction.

—A scheme is now being discussed for making a channel in Irondequoit Bay, New York, deep enough for the admission of lake steamers and building a drawbridge at the outlet. The Lehigh Valley Railroad is interested in the proposition, as it desires to enter into competition for the coal trade of Canada, and if the government will make the bay navigable for lake steamers the Lehigh can bring coal directly from Pennsylvania and load it on Canadian steamers near the Float bridge. It is likely that this plan may be put into execution next year.

—It is reported that the Boston & Maine Railroad Co. has secured estimates for an overhead bridge at Fairmount, Nashua, N. H., to cost $15,000. H. Bissell, chief engineer, Boston, Mass.

—The joint committee of the board of aldermen of Brooklyn and of the Queens county board of supervisors met one day this week in executive session to decide on the class of bridge to be adopted to span Newton creek at Vernon avenue. After hearing Engineer McLaughlin's report, a bascule bridge was decided upon, the report being adverse to a lift bridge, advocated by some of the members of the committee. Neither plans nor costs were considered at the meeting.

—J. W. Starr, representing New York, Baltimore and Philadelphia capitalists,is making arrangements with the West Springfield, Mass., selectmen for erecting a new bridge over the Connecticut river for a proposed electric railway; the estimated cost of the bridge is about $125,000.

—It is stated that the plans for the new bridge which is to span the Passaic river at Jackson street, Newark,N.J.,

have been completed by the engineers of Hudson and Essex counties. The cost of the bridge, with approaches, exclusive of some property to be acquired in that city, will be $100,000. The property to be taken will cost $10,000. Bids will be received until Sept. 28.

—The Northern Pacific Railroad has about completed filling bridges and revising grades on the Lake Superior division. This work has given employment to an average of 4,000 men in all departments. One of the most important pieces of work was filling in the long trestle bridge between Duluth and Superior.

—It is reported that the application of the Mather Bridge & Power Company asking for permission to bridge Niagara Falls at Buffalo, has been favorably reported by the parliamentary committee at Ottawa, Ont.

—Plans have been prepared for a bridge over Fox river at Green Bay, Wis., the structure to be 182 ft. 4 in. long.

—It is reported that work was begun last week on the proposed four span bridge over the Monongahela river for the Braddock & Homestead St. Ry., which is owned by Chas Jutte, of Pittsburgh, Pa.

—It is stated that Major W. H. Heuer, U. S. engineer, Cincinnati, has received an application from an Ashland Company for permission to build a bridge over the Ohio river between Ironton, O., and Ashland, and plans will be submitted to a board of United States engineers, consisting of Col. Gregory, Major Hoxie and Major Heuer for consideration. The bridge is to be mainly for railway purposes. The central span will be 525 ft. long, and the structure from shore to shore will be 1,843 ft. in length.

—Reported that N. B. Rutter and a corps of engineers have begun to lay out the route for a new bridge at Wyoming, Pa., and are preparing specifications for the same.

—The governor of the state of Tamaulipas has ordered an official investigation into the burning of a bridge on the Monterey & Gulf Railroad, recently, causing a loss of $10,000. The repairs to the bridge at San Juan de Los Lagos, on the highway between Mexico and Guadalajara, being at the expense of the government, the chief executive has asked for bids for the work, the cost of which is estimated at $1,406. Bids will be received up to the end of September.

—Arrangements are reported as being made for the construction of an $80,000 bridge over the Allegheny river at Freeport, Pa.

—The work of erecting the steel trestles on the Great Northern Railway line in Duluth at Rice's Point is fast approaching compleiton. This work is almost a mile in length and is being done by the Lassig Bridge & Iron Works of Chicago.

Buildings.

—The Taylor Iron & Steel Co., of High Bridge, N. J., has commenced work on a large pattern shop. When completed a number of additional men will be employed.

—The Victor Manufacturing Co. has selected a site at Aliquippa, Pa., on which to erect a plant instead of Canonsburg. At the latter place the difficulty regarding the right of way for cars could not be adjusted and a new location was secured.

—James Stewart & Co. of St. Louis, Mo., has just completed the one-million bushel grain elevator for the Illinois Central Railway at New Orleans. and will add to the structure a cleaning shed of 250,000 bushel capacity. The company has also under way a 500,000 bushel elevator in East St. Louis for P. P. Williams, a roundhouse for the B. & O. S. W. Ry. at the same place and at Terre Haute is constructing cattle pens for 5,000 head of cattle.

—The new freight house of the Cleveland, Cincinnati, Chicago & St. Louis, or Big Four, at East St. Louis, which is 614 ft. long and 50 ft. wide has been opened for business. It was built to replace the one destroyed by the storm in the spring. The other depot, which is 600 ft. long and 30 ft. wide, and the new roundhouse, which are being constructed, are well under way. The new buildings are more substantial than those that were destroyed.

—The factory which the Bickford Drill & Tool Co., of Cincinnati, O., are putting up will occupy the same site as the old building, namely, the northwest corner of Front and Pike streets. The building will measure 75 ft. in width and 125 ft. in depth. The main building will be four stories high, with an extra erecting room of 25 x 125 ft. This erecting room is equipping with a new Maris crane and will be most convenient for their business in all respects. The main shop will have very large windows on all sides, giving the most perfect light for the men. It will be equipped with very fine arrangements of gas and electric light and for each man employed there will be provided a locker for clothes, etc. The heavy tools will all be placed on special foundations and in this way a perfectly modern shop will take place of the old one. The machinery has all been overhauled during the period of rebuilding and the results which will be obtained in the future will even exceed those of the past.

—The Pennsylvania Railroad Company recognizing Baltimore's importance as a fruit importing city has planned special facilities for handling this trade in winter as well summer. It is intended to enlarge the wharf at the foot of Boston street, in Canton, and build a warehouse which will be heated and lighted especially for fruit storage. Tracks will be laid in the warehouse, so that cars can be run into it and the fruit loaded without coming in contact with a change of temperature even during the coldest days in winter. It is stated that Baltimore is to be a distributing point for southern, West Indian and European fruits of all kinds.

Iron and Steel.

—The Johnson Co., of Lorain, will roll the rails for the Pittsburgh & Birmingham Traction Co. The rails are to be 9 in. high, of the 90 lb. girder pattern, and 60 ft. in length.

—The wire for the new suspension bridge over the Ohio river between Cincinnati, O., and Covington, Ky., is now being delivered, and the work of stringing the wires and making the cables will soon be commenced. The wire is of No. 6 gage, and is delivered on large spools.

—Furnace I of the Edgar Thomson Blast Furnaces at Braddock, has been blown out to be relined and repaired. It was in blast for 18 months. A new jacket, new hearth and new foundations will be put in.

—On the 4th instant a receiver was applied for the Eureka Cast Steel Co. of Chester, Pa., and the court appointed Samuel Lees, of Philadelphia, who filed his bonds with the Delaware County Trust Co. in the sum of $25,000. The application was made by Albert Dutton MacDade, representing H. B. Faunce, one of the stockholders, and it was shown that since the resumption of the plant, after passing out of the hands of the assignee, Samuel Lyons, there has been a loss of $4,500. There are liabilities, in addition to the mortgages amounting to $50,000, of about $17,000, and assets are estimated at about $12,500. The plant has been running behind, it is alleged, since it was reopened.

—The Indiana Steel Casting Co., whose large plant at Montpelier, Ind., is near completion, has assigned. The liabilities are $16,000, while the assets are said to be fully three times that amount. Inability of the company to dispose of its paper is given as the cause of the assignment.

—The Oliver Wire Co.'s rod mill has resumed work after an idleness of two weeks. A number of improvements have been made in the plant.

Machinery and Tools.

—A set of rolls for rolling 18 in. beams have recently been put in at the Homestead Steel Works of the Carnegie Steel Co., Ltd. The minimum weight of these will be 55 lbs. and the maximum weight 70 lbs. Heretofore no size between 15 in. and 20 in. has been rolled at these works.

—An exhibition of machinery will be held in Munich in 1898. American manufacturers have been invited to participate.

—The Brightman Furnace Co., Cleveland, has just sold to the Union Pacific Railway Co., Rock Springs, Wyo., three of its largest stokers. Shipments are being made to England besides, where this stoker is rapidly gaining favor. Contracts now on hand include the following Cleveland firms: Jewish Orphan Asylum (fourth order), the Cleveland Steam Fitting Co., and the B. F. Goodrich Co., Akron, O., fourth order, comprising four large stokers.

—With the shipment of machinery to Nijni Novogorod, Russia, a short time ago was 200 tons from the Morgan Engineering Co. of Alliance, O. The shipment consists of two steam hammers, a hydraulic crane, and a hydraalic flanging press for the locomotive plants of that place, which are being built by Americans.

—The boiler department of the Portland Co., Portland, Me., is a very busy place. Some of the largest boiler and pulp digesters ever constructed are now under way. All the latest appliances for boiler and tank work are found at this place. The company has evidently completed what is no doubt the largest and best equipped foundry in the state. It is erected on the site of the old foundry and is 87x203 ft. with a monitor roof 40 ft. span. A new 20 ton traveling electric crane runs the entire length of the building, and there are in addition two steel jib cranes of 10,000 lbs. capacity, one loam oven 25x19x10 ft. for drying the molds and a core oven 16x8x7 ft. A pickling tank is at present being constructed for pickling the castings, thus making the cleaning of them very much easier. The Callian cupola has a capacity of 100,000 lbs. in six hours.

—The Cincinnati (O.) Milling Machine Co. reports its business as very good, considering the present condition of trade. It has recently made shipments to Rhode Island, Connecticut, New Jersey, Ohio, Pennsylvania, New York, Kentucky, and also to England, Germany, Italy, Russia, Austria, Norway and Sweden.

—Thos. Carlin's Sons of Allegheny, Pa., are shipping many contractors cars and dump tubs for government use. They are also shipping a number of their improved concrete mixers for government work in the east. Also a lot of iron work to Montgomery, Ala., for the government.

—The Edward P. Allis Co., Milwaukee, Wis., has received orders for two cross compound vertical direct acting blowing engines for export to Austria. They are of the same pattern as those recently built for the Carnegie works, and are claimed to be the largest blowing engines ever built. Their weight is about 275 tons each.

—The Murray Iron Works Co. of Burlington, Iowa, has completed and put in operation its new shops built for the manufacture of Corliss engines. It will be remembered that this company bought out last spring the plant of the Sioux City Engine Works and moved its machinery, patterns, drawings, etc., to Burlington. The new shops are now turning out the well known Sioux City Corliss engines under the supervision of the same engineering force that produced them at Sioux City. As the older Murray shops are completely equipped for the manufacture of boilers and slide valve engines, the concern is fully prepared to supply the trade with power plants, both large and small. Despite the hard times the company is now doing the largest business in its 26 years' experience.

—The Niles Tool Works at Hamilton, Ohio is preparing for shipment a large consignment of planers and boring machines to be shipped to Italy and Austria. These machines will weigh over 50 tons each.

Miscellaneous.

—The railway supply trade is in the attitude of almost entirely forced idleness. Railway companies generally have discontinued work to the greatest extent possible, and laid off great numbers of men. Everything is postponed until "after election." If that goes all right, it looks as though the flood gates of business would be opened and every thing will go. Much will depend on the decisiveness of the sound money victory. If overwhelming as it should be, and as the prospects now seem, the country should have some years of good time. There seems to be no lack of hopefulness. Meantime those who have tried it say that even fish are declining to bite until after the election.

—The Duluth & Iron Range Railroad is now constructing a transfer table and pit at its shops at Two Harbors, Minn. The table is 30 ft. long and the pit 170 ft. The foundation for this table consist of 80 masonry piers of Kettle river sandstone laid in Portland cement. On these will be placed four lines of 12 x 12 in. and 12 x 16 in. Oregon fir and 60 lb. rails. The total cost of table and pit will be over $4,000. This road will also put in a system of sanitary sewers for its shops, the work on which will be completed before winter.

—It is understood that the receivers of the Baltimore & Ohio R. R. Co. intend to make the Mount Clare shops, in Southwest Baltimore, the principal repair station along the road. The interior of the place is being practically rebuilt, so as to increase its capacity and enable the mechanics and other employes there to do quicker and better work in repairing the broken-down rolling stock of the company, chiefly passenger coaches and engines. In the brass foundry five new furnaces are being built, which will give the department 10 large furnaces. An iron flooring is being laid in place of the dirt floor, and a large traveling crane built to convey the metal about the place; that was put in to lighten the labors of the men. In the erecting and paint shops automatic scaffolds are being added, which will be a great saving in labor to the employes. Every department will receive attention from the hands of carpenters and other repairers. Within the past few days three new tracks were laid in the lumber yard, and the place is stacked up with massive piles of lumber for the repair shops.

—The Fort Pitt Bridge Works, of Pittsburgh, has been awarded the contract by the United States government for the iron for the movable dams on the Monogahela river. The contract is one of the largest ever accepted by the company.

—James Rees & Sons, of this city, have contracted to build another new steel boat for South America. The firm is just finishing one for that county and will soon be ready to commence on the one last contracted for.

—The works of Shickle, Harrison & Howard are running comfortably full of orders for couplers, general machine castings, and a large amount of street railway work.

—The work of filling the St. Paul & Duluth tracks between their large warehouses at Duluth is about completed. This has been done by Williams, Green & Williams, the dredge contractors who use a large suction pump in transferring the dredged material from the scow to the fill. A large cylinder is first filled with steam, which is afterward condensed by water jets. The resulting vacuum draws the material from the scow, after which it is forced by high steam pressure through 24 in. pipes to a distance of 2,000 ft. if required. The machine has worked very successfully and about 30,000 cu. yds. of material has been moved.

—The Schultz Bridge & Iron Company of McKees Rocks launched another steel boat a few days ago. The craft is 160 ft. in length by 38 ft. beam and 5 ft. depth of hold. The whole boat with the exception of the cabin is steel, even to the rudders. The boat is intended for towing transports across the Missouri river and other harbor work in the vicinity of St. Louis, and is for the Bonne-Terre Transportation Company of St. Louis.

St. Louis Exposition.

Several manufacturers of railway supplies are making exhibits at the St. Louis Exposition which is now in progress. Fairbanks, Morse & Co., are showing hand and velocipede cars, cattle guards, jacks, trucks, wind mills, pumps, scales, gas and gasoline engines, etc. The Western Railway Equipment Co. has on exhibition the Houston track sander, Winslow car roof, St. Louis car door and a selection of malleable castings. Hall & Brown have a very complete exhibit of wood-working machinery both light and heavy. Yerkes & Finan also have a good selection of the same class of machinery. The International Steel Post Co. has an exhibit showing a number of different styles of fencing attached to its post and also a model showing the manner in which the posts are driven into the ground. This model is a work of art and is clear and comprehensive in the extreme. The Chicago Belting Co. has a good display of heavy and light belting. The Shultz Belting Co. also show some excellent samples of belting of all sizes. The St. Louis Steam Engine Co. has on exhibition a number of small steam steam engines and also an air compressor. The main part of the machinery is being run by a Corliss engine made by the St. Louis Iron & Machine Works.